

A broad review on *Amalaki* (*Phyllanthus emblica* linn.,) precious and nutritive Ayurvedic fruit.

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Abstract

Amalaki (*Phyllanthus emblica* linn., family - Phyllanthaceae) is commonly known as amla in hindi and Indian gooseberry in english. It is one of the important ayurvedic herb which is used since ages for treatment of various health problems. Amla has very high nutritive value. It is used as medicinal herb for treatment of diseases as well as in our daily diet in form of pickles, murraba, sweet jams and candies etc. Fruit of amla is widely used in the Indian system of medicine as diuretic, laxative, liver tonic, refrigerant, hair tonic, ulcer preventive, stomachic, restorative, anti-pyretic and for common cold, fever. Various phytochemical studies on amla revealed major chemical constituents like tannins, alkaloids, polyphenols, vitamins and minerals. Gallic acid, ellagic acid, emblicanin A & B, phyllembin, quercetin and ascorbic acid are found to be biologically effective in many ways. Amla is also testified to possess potent free radical scavenging, antioxidant, anti-inflammatory, anti-mutagenic, immunomodulatory activities, which are effective in the prevention and treatment of various diseases like cancer, atherosclerosis, diabetes, liver and heart diseases.

Key words- Amalaki, Anti-cancer, Liver tonic, Anti-oxidant, Diabetes.

Introduction

Medicinal plants are the best gift of nature which play an important role in healthcare system of developing nation and a source of medicament to heal various ailments in the world. They play a vital role to secure our health. Medicinal plants are supposed to be much safer than other pathies in world. Nowadays the use of herbal products has become the chief option for people everywhere because of curing treatment without any side effect. Ayurveda, the oldest health system in the world, explains the uses of amalaki to cure many diseases and promote persons health. We all know that all parts of amalaki are useful in the treatment of various diseases. The most commonly used and important part is fruit among all useful parts. Chemical composition of the amalaki fruit contains more than 80% of water.

Latin name of amalaki is *Phyllanthus emblica* linn. And it belongs to (Family- phyllanthaceae) it is commonly known as 'Amla' or 'amlaki' in Hindi and 'Indian gooseberry' in English. Fruit of *Amalaki* is used in practice. Amlalaki consists pancharas (amla Pradhan, madhur, tikta, katu, kashaya); madhur vipaka and sheeta veerya. It contains ellagic acid, gallic acid, quercetin, kaempferol, embelicanin, flavonoids, glycosides and

proanthocyanidins. Vitamin C, tannins and flavonoids present in Amalaki have very powerful immune-modulatory, antioxidant and anti-cancer properties. It seems reasonable that many of the anticancer properties of this fruit are derived from the tannin and flavanoids content. Tannins from *Amalaki* impairing NF-kappaB inhibition include chebulagic acid, ellagic acid and corilagin. All of them have been shown to have anti-proliferative and pro-apoptotic properties against cancer cells. Amla proves to be one of best drug in Ayurveda and here is one of review in which it is explained in well manner by compiling all the points which are related.

Table no. 1 taxonomical classification ^[1]

Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Rosidae
Order	Euphorbiales
Family	Euphorbiaceae
Genus	Phyllanthus L.
Species	Phyllanthus Linn. emblica

Synonyms

1. Cicca emblica (L.)
2. Kurz Diasperus emblica (L.)
3. Kuntze Dichelactina nodicaulis Hance
4. Emblica arborea Raf.
5. Emblica officinalis Gaertn.
6. Phyllanthus glomeratus Roxb. ex Wall. nom. inval.
7. Phyllanthus mairei H. Lév.
8. Phyllanthus mimosifolius Salisb.
9. Phyllanthus taxifolius D. Don^[2]

• DISTRIBUTION AND HABITAT -

Amla is observed for the duration of the Deccan, sea-coasts districts, Kashmir and on hill slopes up to 200 m. It is common far and wide tropical and sub-tropical India and likewise observed in Burma. It is abundant within the deciduous forests of Madhya Pradesh. It additionally grows

in Pakistan, Sri Lanka, Uzbekistan, Bangladesh, South East Asia, China, and Malaysia.^[3]

Table no. 2 Component Percentage. ^[4]

Moisture	81.2 %
Protein	0.5%
Fat	0.1%
Mineral matter	0.7%
Fibre	3.4 %
Carbohydrate	14.1%
Calcium	0.05 %
Phosphorus	0.02%
Iron	1,2mg/100gm
Nicotinic acid	0.2mg/100gm
Vitamin C	600 mg/100 gm
Vitamin B3	0.4 mg/100 gm



PLANT MORPHOLOGICAL DESCRIPTION

Amla is a small- to medium-sized tree with greenish-grey or red bark, growing to a height of about 8-18 m^[5]. Flowering in March to May and fruiting from

September to November. **Bark-** Thin light grey bark exfoliating in small thin irregular flakes ^[6].

Flowers- Small, inconspicuous, greenish-yellow flowers are borne in compact clusters in the axils of the lower leaves. Male flowers are unisexual and numerous on short, slender pedicels, females few, sub sessile, ovary three celled ^[6].

Leaves- They are 3 mm wide and 1.25-2 cm long, alternate, bifarious, pinnate, leaflets numerous, alternate, linear-obtuse, entire, petioles are striated, round ^[6].

Seeds- Obovate-triangular, 3 celled, seeds 2 in each cell ^[6].

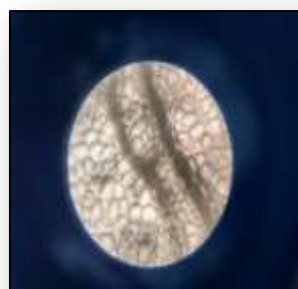
Fruit- Pale yellow, depressed, fleshy, globose, about 2 cm in diameter with 6 obscure vertical furrows enclosing 6 trigonous seeds in 2 seeded 3 crustaceous cocci ^[6].

Fresh fruit consists of fresh fruit pulp of (amla): (a) Macroscopic, (b) microscopic.

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 when mature, with a few dark specks-taste, sour and astringent. ^[7]

Microscopic: Transverse section of mature fruit shows an epicarp consisting of single layer of epidermis 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 thin-walled parenchymatous cells with intercellular spaces, peripheral 6-9 layers smaller, ovoid or tangentially elongated while rest of cells larger in size, isodiametric and radially elongated; several collateral fibrovascular bundles scattered throughout mesocarp consisting of xylem and phloem; xylem composed of tracheal elements, fibre tracheids and xylem fibres; tracheal elements show reticulate scalariform and spiral thickenings; xylem fibres elongated with narrow lumen and pointed end; mesocarp contains large aggregates of numerous irregular silica crystals. ^[8]



T.S of Amalaki fruit

Table no. 3 Different chemical constituents present in various parts of *Phyllanthus emblica*

Parts	Chemical constituent
Fruit	3-6-di-o-galloyl-glucose, Alanine (5.4%), Arginine, Ascorbic acid, Aspartic acid, β -carotene, Boron, Calcium, Carbohydrates, Chebulagic acid, Fiber, Chebulaginic acid, Chebulic acid, Chibulinic acid, Chloride, Chromium (2.5ppm), Copper (3ppm), Corilagic acid, Corilagin, Cystine, Ellagic acid, Emblicanins, Emblicol, Ethyl gallate, Flavonoids, Gallic acid, zinc ethylester, Gallic acid, Gallotanins, Gibberellin-a-1, Gibberellin- a-

	3, Glutamic acid, Glycine, Histidine, Iron, Isoleucine, Kaempferol, Leucine, Lysine, Magnesium, Manganese, Methionine, Myo-inositol, Myristic acid, Niacin, Nitrogen, Pectin, Phenylalanine, Phosphorus, Phyllanthidine, Proline, Phyllantine, Phyllemblic acid, Phyllemblin, Phyllemblic acid, Sulfur, Proanthocyanidins, Proteins, Putranjivin A, Riboflavin, Trigalloyl glucose, Selenium, Serine, Silica, Sodium, Starch, Sucrose, Thiamine, Threonine, Tryptophan, Tyrosine, Valine, Zeatin, Zeatin nucleotide, Gibberellin-a-4, Gibberellina-7, Gibberellin-a-9, Glucogallin, Glucose, Zeatin riboside.
Leaf	Amlaic acid, Astrogalin, Ellagic acid, Gallo-tannin, Kaempferol, Kaempferol-3oglucoside, Phyllanthin, Rutin, Tannin.
Shoot	Chebulagic acid, β -sitosterol, Chibulinic acid, Corilagin, Ellagic acid, Gallic acid, Glucogallin, Lupeol. Bark Leucodelphinidin, Lupeol, β -sitosterol, Betulin, β -Humulene, Friedelan-3one and Tannins.
Seed	Linoleic acid, Linolenic acid, Myristic acid, Oleic acid, Palmitic acid, Phosphatides, Stearic acid, β -sitosterol.
Root	Ellagic acid, Lupeol and Glycosides.
Pericarp	Ellagic acid, Emblicol, Gallic acid and Phyllemblic acid.
Pulp	Pectin, Phosphorus, Potassium, Protein, Reducing sugars, Tannins.
Seed oil	Arachidic acid, Behenic acid, β -sitosterol, Linoleic acid, Linolenic acid, Myristic acid, Oleic acid, Palmitic acid and Stearic acid. ^[9-17]

Table 4 : Amla fruit: Chemical constituents ^[18,19,20]

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, Phyllembin, 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

Traditional uses ^[21,22]

Vermifuge: honey and fruit juice is used.

Appetizer: pickles, jams and candy is made from fresh green fruits.

Irritability of the bladder, in retention of urine: Use a paste of the fruit alone or with *Nelumbium speciosum*, Saffron and

rose water. Should be applied over the affected region.

For hiccup: fruit juice or extract is combined with honey and pipili for treatment.

For hemorrhage, diarrhea: dried fruits are used. A decoction is made from the fruit combined with *T. chebula*

and *T. belerica* is useful in chronic dysentery and biliousness.

For diarrhea of children: A mixture made of powder of the amla seed, Chitrak root, chebulic myrobalan, pippli and palelone should be given in suitable doses, according to age, in warm water twice daily. Tender shoots given in butter-milk cure indigestion and diarrhea, while green fresh leaves combined with curd also used for same.

For anemia, jaundice and dyspepsia: Dried fruit of amla are used with iron. Use of Dhatri Loha for anemia, jaundice and dyspepsia. Dhatri Arista is used for jaundice, dyspepsia, indigestion, and cough.

For burning in the vagina: 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 and white discharge in women.

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.

POTENTIAL THERAPEUTIC APPLICATIONS

Antioxidant

Natural products from dietary components such as Indian spices and medicinal plants possess antioxidant activity.^[23] The study by Poltanov et al., explored the chemistry and antioxidant properties of *P.emblica* fruit extracts. It has been observed that extracts produce positive responses in the total phenol, total flavonoid and total tannin assays.^[24] Reddy et al., suggested that the amelioration of alcohol-induced oxidative stress might be due to the combined effect of phytochemicals such as tannins, flavonoid compounds and vitamin C.^[25] Shivananjappa et al., demonstrated that *P.emblica* aqueous extracts are potent to modulate basal oxidative markers and enhance endogenous antioxidant defences using a hepatocyte cell line (HepG2). Significant

reductions were seen in the levels of lipid hydroperoxide and reactive oxygen species (ROS) was detected in the study that incubated *P.emblica* for 24 h.^[26] When administered once daily for 7 days the active tannoids of *P.emblica* induced a rise in both frontal cortical as well as striatal SOD, CAT and GSH peroxidase (GPX) activity, with associated decline in lipid peroxidation in these brain areas. The results finally say that the antioxidant activity of *P.emblica* may be due to presence of tannoids of the fruits, which have vitamin C-like properties, rather than vitamin C itself.^[27]

Hepatoprotective

The application of natural remedies for the treatment of liver diseases is seen from past many years, beginning with the Ayurvedic treatment, and spreading to the Chinese, European as well as other systems of traditional medicines.^[28] Pharmacological authentication of each hepatoprotective medicinal plant should consist of efficacy evaluation against liver diseases induced by various agents.^[29]

Inflammation and oxidative stress contribute to liver injury. Amalaki is rich in vitamin C, gallic acid, flavonoids, and tannins, prevents against hepatotoxicity-induced liver injury. *P.emblica* supplementation offsets N-nitrosodiethylamine (NDEA) -induced liver injury by its antioxidant, anti-inflammation, anti-apoptosis, and anti-autophagy properties.^[30] Enhanced levels of reduced GSH, GSH peroxidase and GSH reductase were also observed. The results put forward that *P.emblica* inhibits hepatic toxicity in Wistar rats.^[31] Tasduq et al., verified the hepatoprotective activity of a 50% hydroalcoholic extract of the fruits of *P.emblica* (fruit) (EO-50) against anti-tuberculosis drugs-induced hepatic injury. The hepatoprotective property of EO-50 was seen because of its membrane stabilizing, antioxidative and

Cytochrome (CYP) 2E1 inhibitory effects.^[32] In vivo administration of EFE to alcoholic rats significantly brought the plasma enzymes towards normal level and also significantly decreases the levels of lipid peroxidation, protein carbonyls besides restoring both the enzymatic and non-enzymatic antioxidants level. On the basis of data we come to a point that the tannoid, flavonoid and NO scavenging compounds present in EFE may provide protection against free radical mediated oxidative stress in rat hepatocytes with alcohol-induced liver injury.^[33,34] Chronic treatment of CCl₄ and thioacetamide revealed abnormal histopathology suggestive of pre-fibrogenic events. *Phyllanthus emblica* reversed such modifications with substantial regenerative changes indicative of its preventive role in pre-fibrogenesis of liver. The reversal of pre-fibrogenic events could probably be due to its antioxidative activity.^[35-37] The hepato-protective role of the fruits of *P.emblica* was evaluated in adult Swiss albino mice against arsenic-induced hepatopathy. EFE had ameliorated karyolysis, karyorrhexis, necrosis and cytoplasmic vacuolization induced by NaAsO₂ (2) intoxication as demonstrated in liver histopathology.^[38] Fundamental hepatobiology should also be encouraged.^[39]

Nephroprotective

Yokozawa et al., estimated the effects of *P.emblica* on renal dysfunction involved in oxidative stress during the aging process. The increased level of serum creatinine and urea nitrogen in the old rats was reduced by the administration of *P.emblica* extract. The results of this experiment indicated that *P.emblica* would be a very useful antioxidant for the prevention of age-related renal disease.^[40] Chen et al., evaluated whether supplementation with *P.emblica* extract helps to reduce oxidative stress in

patients with uremia. The conclusion of study indicates that supplementation with *P.emblica* extract for 4 months decreased the plasma oxidative marker, 8-iso-prostaglandin, and increased plasma total antioxidant levels in uremic patients.^[41]

Hypolipidemic

A scientific scrutiny should be undertaken to corroborate the recent evidence that some medicinal plants possess lipid-lowering, and immunomodulating properties on account of their rich flavonoid and/or other glucose-lowering active constituents.^[42] The lipid level (cholesterol and triacylglyceride) in serum and liver were markedly elevated in aged control rats, while they were significantly reduced by the administration of *E. officinalis*. The oral administration of *P.emblica* raised the hepatic PPAR α protein level and also significantly inhibited the serum and hepatic mitochondrial thiobarbituric acid-reactive substance levels in aged rats. These results indicate that *P.emblica* may prevent age-related hyperlipidaemia through attenuating oxidative stress.^[43] Use of *P.emblica* produced significant decrease in total cholesterol (TC), low-density lipoprotein (LDL), triglyceride (TG), very LDL, and a significant increase in high-density lipoprotein levels. On seeing the results above, it is suggested that addition of *P.emblica* to the currently available hypolipidemic therapy would offer major protection against atherosclerosis and coronary artery disease.^[44] These results suggest that *P.emblica* may be beneficial in hypercholesterolemia and prevention of atherosclerosis.^[45] Fructose-induced metabolic syndrome is attenuated by the polyphenol-rich fraction of *P.emblica* was suggested by the findings.^[46]

Cardioprotective

Phyllanthus emblica is effective in inhibiting the progress of atherosclerosis by alleviating oxidation injury or by inhibiting ox-LDL-induced vascular smooth muscle cell proliferation, which may be promising mechanisms for treating atherosclerosis.^[47] The effects of the fruit juice obtained from *P.emblica* on myocardial dysfunction in diabetic rats were explored by Patel et al., Treatment with the fruit juice not only prevented the streptozotocin-induced loss of body weight, increases in water and food intake, increases in serum glucose levels and disturbed lipid profile, but also an increase in serum LDH and creatinine kinase-MB levels, and increased myocardial hypertrophy and cardiomyopathy. There was a decrease in antioxidant enzyme levels (in SOD, reduced GSH and CAT) in diabetic hearts, which could be improved by treatment with fruit juice. Hence, *P.emblica* fruit juice may be beneficial for the treatment of myocardial damage associated with type 1 diabetes mellitus.^[48] It can be concluded that the cardioprotective potential of *P.emblica* credited to its potent antioxidant and free radical scavenging activity as evidenced by improvement that favoured in hemodynamic, contractile function as well as tissue antioxidant status.^[49]

Diabetes and Related Complications

Akhtar et al., evaluated the anti-hyperglycemic and lipid-lowering properties of *P.emblica* fruit in normal as well as diabetic human volunteers. The results showed a significant reduction in fasting and 2 h post-prandial blood glucose levels on the 21st day in both normal and diabetic subjects receiving 1, 2 or 3 g *P.emblica* powder per day as matched with their baseline values.^[50] The study conducted by Tiwari et al., demonstrated that *P.emblica* extracts not only attenuated the diabetic condition but also reversed neuropathic pain through

modulation of oxidative-nitrosative stress in diabetic rats.^[51] Even Kumar et al., investigated flavonoid rich fruit extract of *P.emblica* in type II diabetes induced diabetic neuropathy in male Sprague-Dawley rats. *P.emblica* extract significantly restored the changes in lipid peroxidation status and anti-oxidant enzymes (SOD and CAT) levels observed in diabetic rats. Since, *P.emblica* fruit is already in clinical use for diabetic patients it may be evaluated for preventive therapy in diabetic patients at risk of developing neuropathy.^[52]

It was observed that oral administration of a 1:1 mixture of Epigallocatechin gallate (EGCG) and Amla extract (AE) (EOE) for 3 months significantly improved antioxidant defense as well as diabetic and atherogenic indices in uremic patients with diabetes. These results suggest that a 1:1 combination of EGCG with AE is a safe and effective treatment for uremic patients with diabetes.^[53]

Immunostimulant

E. officinalis, an excellent source of vitamin C (ascorbate), has been found to improve natural killer (NK) cell activity and antibody dependent cellular cytotoxicity. *P.emblica* stimulated a 2-fold proliferation in splenic NK cell activity. An increase in life span of 35% was recorded in tumor bearing mice treated with *E. officinalis*.^[54] Additionally, Sai Ram et al., investigated the anti-oxidant and immunomodulatory properties of *P.emblica* using chromium (VI) as an immunosuppressive agent. *P.emblica* also inhibited apoptosis and DNA fragmentation induced by Cr. Interestingly *P.emblica* relieved the immunosuppressive effects of Cr on lymphocyte proliferation and even restored the IL-2 and gamma-IFN production considerably.^[55]

Antimicrobial

The chloroform soluble fraction of the methanolic extract of *P. emblica* presented significant antimicrobial action against some gram-positive and gram-negative pathogenic bacteria with a solid cytotoxicity having a LC50 (lethal concentration) of 10.257 ± 0.770 microg mL⁻¹.^[56] The aqueous extracts of the fruit pulp of *P. emblica* were evaluated by Vijayalakshmi et al., for antimicrobial activity against gram-positive bacteria *Staphylococcus aureus*, gram-negative bacteria *Escherichia coli* and fungal strains of *Candida* species with agar cup plate method. The extracts showed a different degree of activity against pathogenic microbes.^[57] Aqueous infusion and decoction of *P. emblica* exhibited potent antibacterial activity against *E. coli*, *Klebsiella pneumoniae*, *K. ozaenae*, *Proteus mirabilis*, *Pseudomonas aeruginosa*, *Salmonella typhi*, *S. paratyphi A*, *S. paratyphi B* and *Serratia marcescens*.^[58]

Saini et al., evaluated the effect of *P. emblica* administration on the vulnerability of experimental mice to respiratory tract infection induced by *K. pneumoniae*.^[59] Thaweboon et al., demonstrated that *P. emblica* ethanolic extract interferes with the adhesion of *C. albicans* to BECs (human buccal epithelial cells) and denture acrylic surfaces in vitro.^[60]

Promising antiplasmodial activity was found in the extracts from *P. emblica* leaf. They were also found to be active against Chloroquine-resistant strains. These results demonstrate that extracts of *P. emblica* may serve as antimalarial agents even in their crude form.^[61]

Pinmai et al. revealed that in vivo antiplasmodial activity with good suppression activity ranged from 53.40% to 69.46%.^[62] It is suggested that the polyphenolic compound isolated from *P. emblica* might exert anti-herpes simplex virus (HSV) activity both by inactivating extracellular viral particles and by inhibiting the viral biosynthesis

in host cells.^[63] *P. emblica* definitely possesses potent antimicrobial activities, thus serving as an important platform for the development of inexpensive, safe and effective medicines.^[64]

Anticancer

Polyphenols have their action on multiple targets in pathways and mechanisms connected to carcinogenesis, tumor cell proliferation and death, inflammation, metastatic spread, angiogenesis, or drug and radiation resistance.^[65] *P. emblica* indigenous to India is valued for its unique tannins and flavanoids, which contain very powerful antioxidant properties.

Ngamkitidechakul et al., tested the potential anticancer effects of aqueous extract of *P. emblica* in four ways:[1] against cancer cell lines,[2] in vitro apoptosis,[3] mouse skin tumourigenesis and[4] in vitro invasiveness.

The *P. emblica* extract at 50-100 microg/mL specifically inhibited cell growth of six human cancer cell lines, A549 (lung), HepG2 (liver), HeLa (cervical), MDA-MB-231 (breast), SK-OV3 (ovarian) and SW620 (colorectal). The extract was found non-toxic against MRC 5 (normal lung fibroblast). The above results propose *P. emblica* exhibits anticancer action against selected cancer cells, thus it permits further study as a possible chemopreventive and antiinvasive agent.^[66]

The inhibition of tumor frequencies by fruit extract has been estimated on the two-stage process of skin carcinogenesis in Swiss albino mice, induced by a single application of 7, 12-dimethylbenz(a)anthracene, and 2 weeks later, endorsed by repeated application of croton oil till the end of the experiment (16 weeks). Thus, the tumor incidence, tumor yield, tumor burden and cumulative number of papillomas were found to be greater in the control (without *P. emblica* treatment)

as compared to experimental animals (P.emblica treated).^[67] The working of human hepatoma BEL-7404 cells apoptosis that was induced by Galic acid from the leaves of Phyllanthus emblica may have blocked G2/M period in cell life cycle, up-regulating the expression of Bax and down-regulating the expression of Bcl-2 (B-cell lymphoma 2). This can decrease membrane potential of mitochondria, trigger the caspases of activation cascade and induce cell death.^[68] Yang et al., investigated the positive effect of pyrogallol on human lung cancer cell lines-H441 (lung adenocarcinoma) and H520 (lung squamous cell carcinoma).^[69]

Ethanollic extracts of EO fruit extract was investigated for protection against genotoxicity induced by the rodent carcinogen,

7,12-dimethylbenz(a)anthracene

(DMBA). The protection provided by EO may be related with its antioxidant capacity and through its modulatory effect on hepatic activation and detoxifying enzymes.^[70] Rajeshkumar et al., investigated the efficacy of P.emblica polyphenol fraction (EOP) on the induction of apoptosis in mouse and human carcinoma cell lines along with its modulatory effect on NDEA induced liver tumors in rats. The results suggest that EOP treatment might induce apoptosis in Dalton's Lymphoma Ascites and CeHa cell lines.^[71] fruit juice, the branches, leaves, and the roots contain many phenolic compounds which showed a stronger inhibition against B16F10 cell growth than against HeLa and MK-1 cell growth.^[72]

Cyclophosphamide (CP) is one of the most standard alkylating anticancer drugs despite its toxic side effects, including immunotoxicity, hematotoxicity, mutagenicity and a host of others. Haque et al., assessed the protective effects of total aqueous extract of a medicinal plant P.emblica in mice

treated with CP. Not only were the reduced GSH levels significantly increased but the plant extract treatment resulted in restoration of antioxidant enzymes in CP-treated animals. It is suggested that P.emblica or its medicinal preparations may prove to be useful as a component of combination therapy in cancer patients under the CP treatment regimen.^[73]

Phyllanthus emblica according to Ayurveda The Amla fruit has properties given below according the Ayurvedic classifications:

Rasa (taste): most dominant are Sour and astringent while the fruit has five tastes that include sweet, bitter, and pungent.

Veerya (nature): Cool, it is mostly used in treatment of burning sensation in inflammation and also fever which are considered to be manifestations of *pitta* (fire) agitation.

Vipaka (taste developed through digestion): Sweet.

Guna (qualities): Light, dry.

Doshas : It Quietens all three *doshas*: *vata*, *kapha*, *pitta*, and is specific action on *pitta*.

Conclusion

In current era many researches are going on Indian traditional medicinal plants and gained a new recommence. We come across many other systems of medicine that are very effective and instant but they come with a number of side effects which can lead to serious complications further. Ayurvedic herbal medicines are natural and so they are capable to alleviate all these problems. Phyllanthus emblica (Amla) is an important herb in Ayurveda- which is an Indian indigenous system of medicine. Amla has strong antioxidant action and other biological properties which prevent various health disorders as it contains essential nutrients and maximum amount of vitamin C. Many other activities like anti-cancer action, anti- diabetic action,

anti-lipidemic, etc can be seen due to presence of tannins and flavonoids. Amla is also used as rasayan in Ayurveda according to Acharya charak. It has a strong effect in delaying aging and reformation of dhatus in the body.

Even though, *Phyllanthus emblica* has innumerable medicinal activities since ages, there is huge necessity to scientifically explore and evident its medicinal properties at molecular level with assistance of latest biotechnological tools and techniques.

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