



Emblica officinalis (Amla): A review of therapeutic applications

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ABSTRACT:-

Medicinal plants, having great elementary and therapeutic importance, are the gift to mankind to acquire healthy lifestyle. *Emblica officinalis* Gaertn. or *Phyllanthus emblica* Linn. (Euphorbeaceae), commonly known as Indian gooseberry or Amla, has superior value in entirely indigenous traditional system of medicine, including folklore Ayurveda, for medicinal and nutritional purposes to build up lost vitality and vigor. In this article, numerous phytochemicals isolated from *E. officinalis* and its ethnomedical and pharmacological potentials with molecular mechanisms are briefly deliberated and recapitulated. The information documented in the present review was collected from more than 270 articles, published or accepted in the last five to six decades, and more than 20 e-books using various online database. Additional information was obtained from various botanical books and dissertations. The extracts from various parts of *E. officinalis*, especially fruit, contain numerous phytoconstituents viz. higher amount of polyphenols like gallic acid, ellagic acid, different tannins, minerals, vitamins, amino acids, fixed oils, and flavonoids like rutin and quercetin. The extract or plant is identified to be efficacious against diversified ailments like inflammation, cancer, osteoporosis, neurological disorders, hypertension together with lifestyle diseases, parasitic and other infectious disorders. These actions are attributed to either regulation of various molecular pathway involved in several pathophysiology or antioxidant property which prevents the damage of cellular compartments from oxidative stress. However, serious efforts are required in systemic research to identify, isolate and evaluate the chemical constituents for nutritional and therapeutic potentials.

Keywords- Amla, Health Benefits

INTRODUCTION

According to principle of Yoga and Naturopathy sound body, sound mind is necessary for Health. So Amla is a gift of nature to mankind and gifted by mother nature as blessing of God to their children (humans), which gives us healthy and disease free life. Amla (also called Indian Gooseberry in English) is an important medicinal plant. The word

—amla is derived from the Sanskrit word —amla||, which means —the sustainer|| or prosperity. Its fruit pulp is used for rejuvenation (Srivasuki, 2012) purposes and anti-ageing properties (Srivasuki, 2012). It has potent immunomodulatory and antioxidant (Jain et al., 2015). Amalaki reduces free radicals in the body and provides good amount of nutrients, especially Vitamin C. The fruit pulp of an Amla contains 20 times more Vitamin C content than an orange. The Indian gooseberry holds a high place among the fruits which offer a definite contribution to health. The WHO is encouraging, promoting and facilitating the effective use of natural medicine for the developing countries health program (Jain et al., 2015). Indian gooseberry is a wonderful fruit and one of the precious gifts of nature to man. Through centuries the

berry has been the friend of the common man in the East. From time immemorial it has been used as an useful ingredient of various medicines in India and the Middle East. It is enormously used as a tonic to restore the lost body's energy and vigor (Singh et al., 2012). It is equally esteemed both by Hindu and the Muhammadan physicians. It has now been definitely ascertained by laboratory test that no other fruit or foodstuff can stand comparison with this berry as a source of vitamin C (Kulrajan 1983). Amla effective in slowing down the ageing process. Ageing is a cumulative result of damage to various cells and tissues, mainly by oxygen free radicals. Vitamin C is a scavenger of free radicals which breaks them down; it has an antioxidant synergism with vitamin E which prevents pre-oxidation of lipids. Liver toxins, high blood cholesterol and age-related kidney disorders have all been scientifically proven to be corrected with the antioxidant properties contained in Amla berries (Jain et al., 2015). It has been worshiped since ancient times as the —Earth Mother|. The tree is best known for its succulent fruit. The fruit is small and light green in color with six vertical stripes and a hard seed inside. The seed has three angles and three sides.[1]

CLASSIFICATION:-

Kingdom: Plantae Division: Angiospermae Class: Dicotyledonae Order: Geraniales Family: Euphorbiaceae

Genus: Emblica

Species: officinalis Geartn. [1]

USES

Siddha, Unani Tibetan, Sri Lankan, and Chinese systems of medicine utilize *E. officinalis*.

E. officinalis is considered to be a powerful *rasayana* (rejuvenator) and to be useful in delaying the degenerative as well as a senescence process. It helps to increase longevity, improve digestion and to treat constipation. It also diminishes fever, cleanses the blood, decreases cough, eases asthma, strengthens the heart, benefits the eyes, encourages hair growth, invigorates the body, and augments the intellect, as per the ayurvedic system of medicine.

In several folk medicines the fruits, which are astringent, are beneficial in treating ophthalmic problems, dyspepsia, gastritis, hyperacidity, constipation, colitis, hemorrhoids, hematuria, menorrhagia, anemia, diabetes, cough, asthma, osteoporosis, premature graying of hair, weakness and fatigue. *E. officinalis* is also stated to have hepatoprotective, cardioprotective, diuretic, laxative, refrigerant, stomachic, restorative, alterative, antipyretic, and anti-inflammatory properties. Besides being a hair tonic, *E. officinalis* also prevents peptic ulcer dyspepsia, and is a digestive medicine

. [2, 5]

POTENTIAL THERAPEUTIC APPLICATION :ANTIOXIDANT :

Nature has gifted us with defensive antioxidant mechanisms-superoxide dismutase (SOD), catalase (CAT), glutathione (GSH), GSH peroxidases, reductase, vitamin E (tocopherols and tocotrienols), vitamin C, etc., along with several dietary components. Higher consumption of components/nutrients with antioxidant capabilities has been associated with lower frequency of numerous human morbidities or mortalities as per many epidemiological studies. Diverse potential applications of antioxidant/free radical manipulations in prevention or control of disease has been revealed by ongoing research. Natural products from dietary components such as Indian spices and medicinal plants are known to possess antioxidant activity.[6] The study by Poltanov et al., investigated the chemistry and antioxidant properties of *E. officinalis* fruit extracts. Extracts produced positive responses in the total phenol, total flavonoid and total tannin assays.[7]

Hepatoprotective

The utilization of natural remedies for the treatment of liver diseases has a long history, beginning with the Ayurvedic treatment, and spreading to the Chinese, European as well as other systems of traditional medicines.[11] These phytochemicals cannot only be isolated but also be developed as single-ingredient drugs, with quality and standards of modern medicine. Pharmacological validation of each hepatoprotective plant should include efficacy evaluation against liver diseases induced by various agents.

Inflammation and oxidative stress contribute to liver injury. *E. officinalis* which is rich in vitamin C, gallic acid, flavonoids, and tannins, protects against hepatotoxicity-induced liver injury. *E. officinalis* supplementation offsets N-nitrosodiethylamine (NDEA)

-induced liver injury via its antioxidant, anti-inflammation, anti-apoptosis, and anti-autophagy properties.[13] A profound pathological protection to liver cell as described by univacuolated hepatocytes was exhibited by the pretreatment of *E. officinalis* for seven consecutive days. Pretreatment with *E. officinalis* prior to CCl₄(Carbon tetrachloride) intoxication exhibited major decrease in the levels of serum glutamic oxaloacetic transaminase, serum glutamic pyruvic transaminase, lactate dehydrogenase (LDH), GSH-S-transferase, lipid peroxidation (LPO) and DNA synthesis. There was also enhanced levels of reduced GSH, GSH peroxidase and GSH reductase. The results suggest that *E. officinalis* inhibits hepatic toxicity in Wistar rats.[14] Tasduqet al., demonstrated

the hepatoprotective property of a 50% hydroalcoholic extract of the fruits of *E. officinalis* (fruit) (EO-50) against anti-tuberculosis drugs-induced hepatic injury. The hepatoprotective activity of EO-50 was found to be due to its membrane stabilizing, antioxidative and Cytochrome (CYP) 2E1 inhibitory effects.[15] Oxidative stress and ROS-mediated toxicity are considered two of the vital fundamental mechanisms responsible for alcohol-induced liver injury and mitochondrial dysfunction. The effect of *E. officinalis* fruit extract (EFE) against alcohol-induced hepatic damage in rats was explored. EFE possesses antioxidant as well nitric oxide (NO) scavenging activity as per in vitro studies.

In vivo administration of EFE to alcoholic rats significantly brought the plasma enzymes towards near normal level and also significantly reduced the levels of lipid peroxidation, protein carbonyls besides restoring both the enzymatic as well as non-enzymatic antioxidants level. This observation was supported by histopathological examination in liver. Thus, this data suggests that the tannoid, flavonoid and NO scavenging compounds present in EFE may offer protection against free radical mediated oxidative stress in rat hepatocytes of animals with alcohol-induced liver injury. Chronic treatment of CCl₄ and thioacetamide revealed abnormal histopathology suggestive of pre-fibrogenic events. EO 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 favorable antioxidative activity. [18,20]

NEPHROPROTECTIVE:-

Yokozawa et al., investigated the effects of *E. officinalis* on renal dysfunction involved in oxidative stress during the aging process. The raised level of serum creatinine and urea nitrogen in the aged rats was decreased following the administration of *E. officinalis* extract. Furthermore, the tail arterial blood pressure was significantly diminished. Thiobarbituric acid-reactive substance levels of serum, renal homogenate, and mitochondria in aged rats too were considerably reduced by the extract, suggesting that *E. officinalis* would ameliorate oxidative stress due to aging. The increases of inducible nitric oxide synthase (iNOS) and cyclooxygenase (COX)-2 expressions in the aorta of aging rats were also significantly

suppressed. The expressions of renal nuclear factor-kappaB, inhibitory kappaB in cytoplasm, iNOS, and COX-2 protein levels were also increased with aging. These results indicate that *E. officinalis* would be a very useful antioxidant for the prevention of age-related renal disease.[] Chen et al., assessed whether supplementation with *E. officinalis* extract could diminish oxidative stress in patients with uremia. The outcomes indicate that supplementation with *E. officinalis* extract for 4 months reduced the plasma oxidative marker, 8-iso-prostaglandin, and increased plasma total antioxidant

status in uremic patients.[25]

HYPOLIPIDEMIC :-

The silent epidemic of ischemic heart disease, type 2 diabetes mellitus (T2DM), hypertension, and stroke is being currently faced in India. Indian people develop both diabetes and ischemic heart disease a decade earlier compared to whites. A scientific scrutiny should be undertaken to corroborate the recent evidence that certain medicinal plants possess hypoglycemic, lipid-lowering, and immunomodulating properties on account of their rich flavonoid and/or other glucose-lowering active constituents

The lipid levels, such as cholesterol and triacylglyceride, in serum as well as liver were markedly elevated in aged control rats, while they were significantly decreased by the administration of *E. officinalis*. Peroxisome proliferator-activated receptors (PPAR α) is known to regulate the transcription of genes involved in lipid and cholesterol metabolism. The PPAR α protein level in liver was reduced in aged control rats. However, the oral administration of *E. officinalis* significantly increased the hepatic PPAR α protein level. In addition, oral administration of *E. officinalis* significantly inhibited the serum and hepatic mitochondrial thiobarbituric acid-reactive substance levels in aged rats. These results indicate that *E. officinalis* may prevent age-related hyperlipidaemia through attenuating oxidative stress in the ageing process.[26] Treatment with *E. officinalis* produced significant reduction of total cholesterol (TC), low-density lipoprotein (LDL), triglyceride (TG), very LDL, and a significant increase in high-density lipoprotein levels. In view of the above results, it is recommended and adverse effects of the hypolipidemic agents[27]

METALIC SYNDROME :-

The Ethyl acetate extract of *E. officinalis* ameliorated the high fructose-induced metabolic syndrome, including hypertriacylglycerolaemia and hypercholesterolaemia. These findings suggest that fructose-induced metabolic syndrome is attenuated by the polyphenol-rich fraction of *E. officinalis*.

[29]

CARDIOPROTECTIVE :-

The main etiologic factor in atherogenesis is ox-LDL, and antioxidants are accepted as effective treatment of atherosclerosis. Results suggest that *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.

Regularization of hyperglycemia, hyperlipidemia and oxidative stress are important objectives in averting diabetes-induced cardiac dysfunction. The effects of the fruit juice obtained from *E. officinalis* 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, *E. officinalis* fruit juice may be beneficial for the treatment of myocardial damage associated with type 1 diabetes mellitus. The activity of *E. officinalis* fruit juice can be attributed to the concentration of the polyphenol present.[31].

DIABETIC :-

Diet has been recognized as a corner stone in the management of diabetes mellitus. Fenugreek seeds (*Trigonella foenumgraecum*), garlic (*Allium sativum*), onion (*Allium cepa*), and turmeric (*Curcuma longa*) have been experimentally documented to possess antidiabetic potential. Cumin seeds (*Cuminum cyminum*), ginger (*Zingiber officinale*), mustard (*Brassica nigra*), curry leaves (*Murraya koenigii*) and coriander (*Coriandrum sativum*) have been reported to be hypoglycaemic in a limited number of studies[33]

Diabetic neuropathy is one of the most common

microvascular complications of diabetes mellitus, which distresses more than 50% of diabetic patients. The study conducted by Tiwari et al., demonstrated that *E. officinalis* extracts not only attenuated the diabetic condition but also reversed neuropathic pain through modulation of oxidative-nitrosative stress in diabetic rats.[35] Even Kumar et al., investigated flavonoid rich fruit extract of

E. officinalis in type II diabetes induced diabetic neuropathy in male Sprague-Dawley rats. Treatment with *E. officinalis* extract (EOE) in diabetic rats displayed a significant increase in tail flick latency in hot immersion test and pain threshold level in hot plate test compared to control rats. *E. officinalis* extract significantly restored the changes in lipid peroxidation status and anti-oxidant enzymes (SOD and CAT) levels observed in diabetic rats. Diabetic-induced axonal degeneration too was attenuated by *E. officinalis* extract. The study provides experimental evidence of the preventive and curative effect of *E. officinalis* on nerve function and oxidative stress in the animal model of diabetic neuropathy. Since, *E. officinalis* fruit is already in clinical use for diabetic patients it may be evaluated for preventive therapy in diabetic patients at risk of developing neuropathy.[36]

IMMUNOSTIMULANT :-

There are many plants having immunostimulatory activity.[38] *E. officinalis*, an excellent source of vitamin C (ascorbate), has been found to improve natural killer (NK) cell activity and antibody dependent cellular cytotoxicity. *E. officinalis* 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*. [39] Additionally, Sai Ram et al., investigated the anti-oxidant and immunomodulatory properties of *E. officinalis* using chromium (VI) as an immunosuppressive agent. Cytotoxicity, free radical production, lipid peroxidation, decreased GPx activity and diminished GSH levels is caused by chromium. Both lipopolysaccharide and concanavalin-A-stimulated lymphocyte proliferation were also significantly inhibited. Chromium also inhibited concanavalin-A stimulated interleukin-2 and gamma-interferon production. Presence of Cr enhanced apoptosis and DNA fragmentation. *E. officinalis* significantly inhibited Cr-induced free radical production, and restored the anti-oxidant status back to control level. *E. officinalis* also inhibited apoptosis and DNA fragmentation induced by Cr. Interestingly *E. officinalis* relieved the immunosuppressive effects of Cr on lymphocyte proliferation and even restored the IL-2 and gamma-IFN production considerably.[40]

ANTIMICROBIAL :-

Infectious diseases are a major reason of morbidity and mortality globally. It accounts for roughly 50% of all deaths in tropical countries and as much as 20% of deaths in the America. Notwithstanding the noteworthy advancement made in microbiology in addition to the control of microorganisms, intermittent occurrences of epidemics due to drug resistant microorganisms and previously unknown disease-causing microbes pose a huge risk to public health. These adverse health developments demand a universal initiative for the development of novel approaches for the prevention and treatment of infectious disease. For over 100 years chemical compounds isolated from medicinal plants have served as the models for many clinically proven drugs, and are now being re-assessed as antimicrobial agents. The explanations for this revival include a decrease in the new antibacterial drugs in the pharmaceutical pipeline, a proliferation in antimicrobial resistance, and the plant species have been tried against hundreds of bacterial strains in vitro and many medicinal plants are active against a wide range of gram positive as well as gram-negative bacteria. [41]

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