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Review

Traditional knowledge to clinical trials: A review on therapeutic actions of *Emblica officinalis*



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ABSTRACT

Plants are the integral part of the traditional indigenous healthcare system and are becoming concrete source of new drug discovery, evident by the increasing numbers of modern drugs derived from the phytochemicals. *Emblica officinalis* Gaertn. or *Phyllanthus emblica* Linn (family Phyllanthaceae) has been explained extensively and well documented for its therapeutic efficacies in indigenous system of medicine, in India. Every part of this plant possesses high medicinal value but fruits are the most valuable part in folklore and therapeutic uses. The polyphenols found in *E.officinalis*, especially tannins and flavonoids are key responsible elements for major bioactivities. *E.officinalis* is one of the major component in various health tonics, also exerts synergistic effects in enhancing the medicinal efficacy. *E. officinalis* exhibits broad spectrum of pharmacological activities through various mode of actions including antioxidant, anticancer, immunomodulator, anti-inflammatory, cyto-protective properties etc. Medical practitioners across the globe also advocated its application in managing diabetes, dyslipidemia, obesity, several types of cancer, liver disorders, arthritis, gingivitis, wound healing etc.

The present review analysed and summarized the pharmacological actions, experimental studies and clinical trials of *E. officinalis* with emphasis on its immuno-enhancer, antiinflammatory and anticancer activities and possible mechanism of actions to provide future directions in translating these findings clinically.

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1. Introduction

Medicinal uses of herbals are well recognized in the Indian subcontinent and their global demand is continuously increasing [1]. It is estimated that more than half of the percentage of modern drugs have been originated from different forms of natural resources [2]. World Health Organization (WHO) has emphasized on the use of traditional medicines and reported that major part of the population from developing countries depends on the herbal remedies for their healthcare needs [3]. The significant advantages of therapeutic uses of medicinal plants is due to their safety besides being economical and effective [4]. Many medicinal or dietary plants and their constituents are capable of retarding various pathological stages of diseases [5].

Emblica officinalis Gaertn. (Syn. *Phyllanthus emblica* Linn.) is an important medicinal plant in Ayurveda and Unani systems of medicine and one of the key constituents used in various herbal formulations including patented drugs [6]. In Indian subcontinent it is also known as Amla in Hindi, Amalaki in Sanskrit and Indian Gooseberry in English. The fruit of amla has high medicinal value and commonly used as a tonic to restore the energy and strength. The fruit has been extensively studied for its phytoconstituents, biological activities, therapeutic potential and shown to possess diverse spectrum of activities viz. antidiabetic, anti-inflammatory, antioxidant, hepato-protective, radio-modulatory, immuno-modulatory etc. [7–9]. The goal of this review is to provide critical insights on traditional uses, preclinical studies and clinical trials of *E. officinalis*.

2. Phytochemical constituents of *Emblica officinalis*

During recent years, a number of scientific literature reported various phyto-constituents of the *E. officinalis*. The fruit of amla consists of many bioactive compounds including ellagic acid, chebulinic acid, apigenin, gallic acid, quercetin, chebulagic acid, isostrictiniin, corilagin, methyl gallate, luteolin etc [10]. Emblicanin A, emblicanin B, phyllaemblicin B, punigluconin and pedunculagin are the tannins which are also present in the fruit extract of *E. officinalis* [11]. It has been reported that 100 g of edible fruit provides 470–680 mg of Vit. C. The phytoconstituents of fruits, seeds and leaves are well mentioned in ayurveda and published scientific literatures [12,13] and we have summarized this information in Table 1. Recently Gupta et al. (2014) identified Quercetin and β -sitosterol in ethanolic extracts of *E. officinalis* leaves [14]. Another study by Balasubramanian et al. (2014) reported the presence of five major phyto-constituents including 1, 2, 3-benzenetriol (synonym: Pyrogallol), 5-hydroxymethylfurfural, 2-Acetyl-5-methylfuran (synonym: 5-methyl-2-furylmethyl ketone), benzoic acid and gallic acid in the methanolic extract of amla leaves [15]. Recently, two new chalconoid analogues, emblirol A (1) and B (2), having molecular formula $C_{19}H_{24}O_6$ were isolated from the roots of *P. emblica* [16]. It is very important to explore various phytochemicals present in different parts of *E. officinalis* and understand their therapeutic role along with mechanistic action in combating various disorders. Already known phytocompounds may also be subjected to docking studies to understand their targets and related therapeutic actions.

3. Medicinal uses of *Emblica officinalis*: traditional knowledge and ayurveda

Since last four decades number of scientific studies were conducted to validate the traditional and ethno-medical uses of amla. In these studies, amla has been proved to be an effective medicinal remedy to treat and prevent wide range of disorders. Due to various beneficial medicinal actions, amla is one plant of

Table 1
Phytoconstituents of *Emblica officinalis* [10–15].

Plant Part	Phyto-constituents	Quantity
Fruit	Moisture	81.2%
	Protein	0.5%
	Fat	0.1%
	Mineral matter	0.7%
	Fiber	3.4%
	Carbohydrate	14.1%
	Calcium (Ca)	0.05%
	Potassium (K)	0.02%
	Iron (Fe)	1.2 mg/100 g
	Nicotinic acid ($C_6H_5NO_2$)	0.2 mg/100 g
	Vitamin C ($C_6H_8O_6$)	600 mg/100 g
	In Fresh fruit pulp	720 mg/100 g
	In Processed juice	921 mg/100 cc
	Proteins	
	Glutamic acid	29.6%,
	Proline	14.6%,
	Aspartic acid	8.1%,
	Alanine	5.4%
	Lysine	5.3%
	Tannin	
	Gallic acid	5.0%
	Phyllemblic acid	6.3%
	Emblicanin A	7%
Emblicanin B	333%	
Punigluconin	12%	
Pedunculagin	14%	
Albumin	13.08%	
Crude cellulose	17.08%;	
Lipids	6.0%	
Seeds	Sterol Content	2.70%
	Saturated fatty acid	7.0%
	Linolenic acid	8.78%
	Linoleic acid	44.0%
	Oleic Acid	28.40%
	Stearic acid	2.15%
	Palmitic acid	2.99%
	Myristic acid	0.95%
Leaves	luteolin-4'-O neohesperidoside	–
	1,2,3,4,6-penta-Ogalloylglucose	–
	Trihydroxysitosterol	–

interest for botanists, biotechnologists and phytochemists. Researchers around the globe are working to explore newer medicinal activities and validate the claimed ethnomedicinal properties of amla and its constituents.

In ayurvedic system, the equilibrium between three humors of human body; vata, pitta and kapha are considered key requirement for good health and build capacity of body to resist diseases. The balanced dietary considerations and natural products are the major sources of immunity enhancers. Amla, is one of the widely accepted Rasayana; having universal health benefits. In Ayurvedic literature it is mentioned that, dried amla fruits extract is useful for range of ailments including anemia, leprosy, cough, asthma, hemorrhages, liver and digestive problems. Apart from Indian traditional practices, amla is commonly used in whole South Asia; in Tibetan medical literature fruits are recommended to reduce body temperature in fever, as an anti-inflammatory and diuretic [17]. Fruits are commonly used for treatment of diarrhea, dysentery and helminthic infections [18]. The medicinal uses of amla mentioned in ayurveda are summarized in Table 2 [19]. Summary of therapeutic properties and applications of amla as curative and preventive solutions in various diseases are depicted in Fig. 1. Key constraint in promotion and development of herbals in global market is lack of scientific proof of efficacy and safety. Scientific validation, value addition and product development efforts are very much needed to translate indigenous and

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