JOURNAL OF NATURAL REMEDIES
DOI: 10.18311/jnr/2025/49751

SHORT REVIEW

Amla's Role in Modern Therapeutics for Disease Prevention and Management: A Narrative Review

Meghana Patel[1], Siddharth Thakkar[2*], Shubham Darda[2], Varsha Shah[3] and Jitendra Lakhani[4]

[1]Department of Clinical Nutrition and Dietetics, SBKSMI and RC, Sumandeep Vidyapeeth Deemed to be University, Vadodara - 391760, Gujarat, India

[2]Department of General Medicine, SBKSMI and RC, Sumandeep Vidyapeeth Deemed to be University, Vadodara - 391760, Gujarat, India; sidthakker98@gmail.com

[3]Department of Pediatrics and Prakruti Integrated Health Centre, Sumandeep Vidyapeeth Deemed to be University, Vadodara - 391760, Gujarat, India

[4]Department of General Medicine and Prakruti Integrated Health Centre, Sumandeep Vidyapeeth Deemed to be University, Vadodara - 391760, Gujarat, India

Abstract

Emblica officinalis (Amla), a cornerstone of traditional Indian medicine, has gathered significant scientific attention for its diverse pharmacological properties and therapeutic potential. It is rich in ascorbic acid and a wide spectrum of bioactive phytochemicals such as polyphenols, flavonoids, tannins, and alkaloids. *Amla* exhibits potent antioxidant, anti-inflammatory, immunomodulatory, hepatoprotective, and antimicrobial effects. Contemporary research has increasingly validated its traditional uses and demonstrated its efficacy in managing a range of chronic and non-communicable diseases, including diabetes, cardiovascular disorders, dyslipidemia, cancer, and neurodegenerative conditions. Moreover, its adaptogenic and metabolic resilience-enhancing properties further underscore its value in preventive healthcare. This narrative review critically synthesises literature on the phytochemistry, pharmacological activities, and clinical relevance of *E. officinalis*, aiming to provide a comprehensive understanding of its mechanisms of action and therapeutic applications. The review also identifies existing research gaps and outlines directions for future investigation, positioning *Amla* as a promising candidate in the development of natural, safe, and effective therapeutic agents.

Major Findings: *Amla* (*Emblica officinalis*) is a rich source of vitamin C, polyphenols, and tannins, exhibiting strong antioxidant, anti-inflammatory, and immunomodulatory effects. Preclinical and clinical studies support its benefits in managing lifestyle-related disorders such as dyslipidemia, diabetes, cardiovascular disease, and gastrointestinal and neurodegenerative conditions. Despite its therapeutic promise, wider use is limited by taste, awareness, and accessibility, highlighting the need for innovative formulations and large-scale clinical validation.

Keywords: *Amla*, Antioxidant, Cardioprotective, *Emblica officinalis,* Hypolipidemic, Immunomodulatory

1. Introduction

Amla (*Emblica officinalis* Gaertn.), or Indian gooseberry, is a medicinal plant extensively used in traditional systems of medicine such as *Ayurveda*, *Unani*, and *Siddha*. It is a rich source of vitamin C, polyphenols, flavonoids, and tannins, notably emblicanin A and B, which contribute to its potent antioxidant, anti-inflammatory, antimicrobial, and immunomodulatory effects. These properties have drawn increasing attention for their potential role in preventing and managing a range of chronic, lifestyle-related disorders[1].

Lifestyle disorders such as hypercholesterolemia, diabetes mellitus, hypertension, obesity, and

*Author for correspondence

Article Received on: 10.05.2025 Revised on: 09.08.2025 Accepted on: 20.08.2025

cardiovascular diseases are often linked to oxidative stress, chronic inflammation, and metabolic dysregulation. Modern pharmacological research has begun to explore the potential of *Amla* in mitigating these conditions through mechanisms such as lipid profile improvement, glycemic control, blood pressure regulation, and enhancement of antioxidant defenses. Several experimental and clinical studies have reported beneficial effects of *Amla* in hypercholesterolemia, type 2 diabetes, atherosclerosis, ischemic heart disease, non-alcoholic fatty liver disease, and skin ageing, among others.

Despite promising findings, much of the available evidence is scattered across isolated studies. There is a need for a focused review to consolidate existing knowledge, identify research gaps, and generate robust data supporting the integration of *Amla* into preventive and therapeutic strategies for lifestyle disorders.

This narrative review synthesises current evidence on the phytochemistry, pharmacological activities, and clinical relevance of *Amla*, with particular emphasis on its role in hypercholesterolemia and other major lifestyle-related conditions. By bringing together traditional wisdom and contemporary scientific data, this work aims to provide a comprehensive perspective that can inform future research and potential clinical applications.

2. Materials and Methods

The articles published in PubMed, Scopus, Web of Science, Google Scholar, ScienceDirect, and AYUSH Research Portal were analysed for this review article. The keywords used for the database search included "*Emblica officinalis*", "*Phyllanthus emblica*", "*Amla*", "antioxidant activity", "pharmacological properties" and "therapeutic applications". Only articles published in English were included in this review. No other exclusion criteria were applied regarding journal, year, author, or country of publication.

In the next stage, all the articles obtained from the database search were compiled and screened first by reading their titles and then their abstracts. Studies that satisfied the inclusion criteria, namely, those focusing on phytochemistry, pharmacological effects, antioxidant potential, antimicrobial activity, and therapeutic applications of *Emblica officinalis,* were retained at this stage, while others were excluded. The selected articles were then screened in detail and were analysed further to synthesise and critically evaluate the available evidence.

3. Phytochemical Constituents of *Amla*

Amla (*Emblica officinalis*), also known as Indian gooseberry, is a small, greenish-yellow fruit traditionally revered in Indian medicine for its wide range of therapeutic benefits (Figure 1). Belonging to the family *Phyllanthaceae*, it has been used for centuries in *Ayurveda* as a *Rasayana* (rejuvenating agent) due to its reputed ability to promote longevity, enhance immunity, and combat disease[1]. It is often referred to as "*Pachak Amla*". "*Pachak*" means "digestive" in Hindi, and Pachak *Amla* is a traditional digestive aid made from dried and sometimes spiced *Amla*. In addition to its role in traditional formulations like *Triphala* and *Chyawanprash*, *Amla* is gaining scientific attention for its rich phytochemical profile and potent biological activities.

Amla is particularly noted for its exceptional vitamin C content, which can be 20 times greater than that of an orange[2]. This contributes significantly to its antioxidant capacity, helping neutralise free radicals and reduce oxidative stress. *Amla* has an ORAC (Oxygen Radical Absorbance Capacity) value of 261,500 per 100 grams. A study conducted on different Thai medicinal plants used for diabetes revealed that *Amla* has the strongest antioxidant activity and the highest total polyphenol and tannin content[3]. In addition to ascorbic acid, *Amla* contains a wide spectrum of bioactive compounds, including polyphenols (gallic acid, ellagic acid), flavonoids (quercetin, kaempferol), tannins



Figure 1. *Amla* fruit and tree (*Emblica officinalis*).

(emblicanin A and B), alkaloids, and terpenoids[4]. These constituents are responsible for its broad-spectrum pharmacological effects, including anti-inflammatory, immunomodulatory, hepatoprotective, antidiabetic, and cardioprotective activities.

Emblicanins A and B, unique to *Amla*, are hydrolysable tannins that exhibit remarkable antioxidant properties comparable to synthetic antioxidants like Butylated Hydroxytoluene (BHT)[5]. These phytochemicals also play a role in modulating various biological pathways, including lipid metabolism, glucose homeostasis, and inflammatory cascades. Due to this diverse phytochemical composition, *Amla* is not only valuable in traditional medicine but is also being explored for use in modern pharmacotherapy and functional foods.

Recent investigations support *Amla*'s efficacy in mitigating metabolic disorders, managing oxidative stress-related conditions, and improving gastrointestinal health[6]. The convergence of traditional knowledge and modern scientific validation underscores *Amla*'s significance as a multipotent medicinal fruit with global therapeutic relevance.

4. Therapeutic Roles of *Amla* in Health and Diseases

Modern pharmacological investigations have validated many of the traditional claims regarding *E. officinalis* by identifying a wide spectrum of bioactive compounds, including ascorbic acid (vitamin C), gallic acid, ellagic acid, quercetin, emblicanin A and B, and various polyphenols and flavonoids[4]. These constituents exhibit potent antioxidant, anti-inflammatory, immunomodulatory, and cytoprotective effects that support their therapeutic utility in various disease conditions (Figure 2).



Figure 2. Benefits of *Amla* in systemic diseases.

Amla has shown effective antimicrobial properties like antifungal, antiviral and antibacterial activities, and thus this plant is being explored for developing novel and alternative antibacterial treatment options owing to its potent medicinal values[7]. In one of the studies conducted in 2022, *Amla* supplementation significantly reduced the severity of clinical symptoms like fever, cough, shortness of breath, myalgia, LOS, and a significant improvement in SpO2 and CRP levels[8].

4.1 Hypolipidemic Effects

Amla (*Emblica officinalis*) has been extensively investigated for its hypolipidemic effects, particularly in individuals with dyslipidemia and metabolic syndrome. Its key phytoconstituents, ellagitannins, gallic acid, and flavonoids are known to modulate lipid metabolism through multiple mechanisms.

Preclinical studies have demonstrated significant benefits. In hypercholesterolemic white rabbits, administration of *Amla* extract (10 and 20 mg/kg/day) for 4 months led to marked improvements in lipid profiles, reductions in tissue cholesterol, restoration of normal aortic morphology, and suppression of HMG-CoA reductase activity. These effects were attributed to its potent antioxidant properties, prevention of LDL oxidation, and ability to elevate HDL levels, thereby enhancing reverse cholesterol transport[9].

A 12-week randomized trial reported that *Amla* extract significantly reduced total cholesterol, triglycerides, LDL-C, VLDL-C, and the atherogenic index of plasma in dyslipidemic individuals, alongside a favorable shift in the Apo B/Apo A1 ratio. Unlike statins, these benefits were achieved without lowering CoQ10 levels. Interestingly, a hypoglycemic trend was also observed, indicating potential for managing both general and diabetic dyslipidemia[10]. Moreover, *Amla* supplementation was associated with a 20 % reduction in Lp(a) levels, a marker strongly linked to cardiovascular risk.

In a randomised, double-blind, placebo-controlled pilot study, *E. officinalis* fruit extract demonstrated significant improvements over placebo in lipid profile, cardiovascular risk factors, antioxidant status, and genotoxicity markers, with no reported adverse effects[11]. Mechanistically, *Amla* appears to inhibit HMG-CoA reductase activity, similar to statins, thereby reducing endogenous cholesterol synthesis. Its antioxidant capacity further prevents oxidation of LDL particles, an early step in atherogenesis, making it a valuable dietary adjunct for cardiovascular and metabolic health.

Supporting these findings, Gopa *et al.*, demonstrated that *E. officinalis* treatment significantly reduced total cholesterol, LDL, VLDL, and triglycerides, while increasing HDL levels in hyperlipidemic patients. These results highlight its potential as a complementary therapy to conventional lipid-lowering drugs, possibly enhancing cardiovascular protection while minimising the dosage and associated side effects[12].

4.2 Cardioprotective Actions

The cardioprotective role of *Amla* is attributed to its ability to regulate blood pressure, improve endothelial function, and reduce oxidative stress and inflammation factors central to cardiovascular health. Studies have shown that *Amla* enhances nitric oxide availability, thus improving vasodilation and reducing arterial stiffness.

Moreover, *Amla* has been shown to suppress the expression of pro-inflammatory cytokines (such as TNF-α and IL-6) and reduce cardiac lipid peroxidation markers in experimental models of myocardial infarction. These actions collectively mitigate myocardial damage, prevent plaque formation, and improve overall cardiac function. Its adaptogenic properties also help the body cope with physical and oxidative stress, thereby indirectly supporting heart health. A study conducted by Patel *et al.* investigated the cardioprotective effects of *Emblica officinalis* juice in diabetic rats. The treatment mitigated streptozotocin-induced hyperglycemia, dyslipidemia, weight loss, and elevated water and food intake. It also reduced serum LDH and CK-MB levels, as well as signs of myocardial hypertrophy and cardiomyopathy, suggesting its potential in preventing diabetes-induced cardiac dysfunction[13].

A study by Gopa B and colleagues demonstrated that both *Amla* and simvastatin therapies led to reductions in blood pressure among hypertensive patients. Notably, the blood pressure-lowering effect was more significant in the group receiving *Amla*. Additionally, *Amla* has shown potential in reducing oxidative stress and inhibiting the onset and progression of hypertension, as well as cardiac and renal hypertrophy, in a DOCA-salt-induced hypertensive rat model. This effect is thought to be mediated through the regulation of Endothelial Nitric Oxide Synthase (eNOS) activity, enhancement of endogenous antioxidant levels, increased serum nitric oxide (NO), and improved electrolyte balance[12].

Additionally, a study conducted by Shreesh Ojha *et al.,* revealed that *Emblica officinalis* (100, 250, and 500 mg/kg) showed significant cardioprotective effects against isoproterenol-induced cardiotoxicity in rats by improving hemodynamic function, preserving antioxidants, and reducing lipid peroxidation. Its protective action is attributed to potent antioxidant and free radical scavenging properties, as confirmed by histopathological improvements and enzyme level restoration[14].

4.3 Immunomodulatory and Antioxidant Properties

Many plants are having immunostimulatory activity. *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 tumour-bearing mice treated with *E. officinalis*[15]. 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[16].

4.4 Gastroprotective

Emblica officinalis has demonstrated notable gastroprotective effects, particularly in Non-Steroidal Anti-Inflammatory Drug (NSAID)-induced gastropathy, largely attributed to its potent antioxidant activity. Preclinical studies indicate that *Amla* extracts enhance gastric mucus and hexosamine secretion, thereby strengthening mucosal defence mechanisms.

In various experimental ulcer models in rats, including those induced by aspirin, ethanol, stress, and acetic acid, *E. officinalis* exhibited significant, dose-dependent prevention and healing of gastric lesions. These protective effects are believed to result from a combination of free radical scavenging, enhancement of endogenous antioxidant defences, and maintenance of mucosal integrity.

Beyond ulcer protection, *Amla* also displays antidiarrheal and spasmolytic activities, supporting its traditional use in gastrointestinal ailments. Mechanistic investigations suggest that these effects may be mediated through dual inhibition of muscarinic receptors and blockade of calcium channels, thereby reducing intestinal hypermotility and fluid secretion. In a study by Mehmood *et al.*, crude extract of *Phyllanthus emblica* (500–700 mg/kg) significantly reduced diarrhoea and intestinal spasms in mice, confirming both anticholinergic and calcium channel-blocking actions[17].

Collectively, these findings indicate that *Amla* offers a multifaceted approach to gastrointestinal health, providing gastroprotection, reducing motility-related disorders, and supporting overall digestive function, making it a promising adjunct in the management of gastric ulcers and functional bowel disturbances.

4.5 Nephroprotective Properties

Amla exhibits potent nephroprotective effects, particularly through its ability to combat oxidative stress, a major contributor to renal dysfunction. Studies have demonstrated its efficacy in reducing serum creatinine and urea levels, improving glomerular function, and decreasing markers of oxidative damage in renal tissues. It downregulates the expression of pro-inflammatory markers such as inducible nitric oxide synthase (iNOS) and Cyclooxygenase-2 (COX-2), thereby protecting the kidneys from age-related and toxin-induced damage.

Yokozawa *et al.*, found that *E. officinalis* extract improved age-related renal dysfunction in rats by lowering serum creatinine, urea nitrogen, and blood pressure. It also reduced oxidative stress markers in serum, kidney tissue, and mitochondria, while down regulating pro-inflammatory proteins like iNOS, COX-2, and NF-κB[18]. Similarly, Chen *et al.*, reported that four months of *E. officinalis* supplementation in uremic patients decreased oxidative stress (8-iso-prostaglandin) and enhanced total antioxidant capacity, indicating its potential as a protective antioxidant in kidney-related aging conditions[19].

4.6 Osteo-Protective Potential

Emblica officinalis (*Amla*) has demonstrated promising osteoprotective properties, suggesting its potential role in the management of bone-related disorders such as rheumatoid arthritis and osteoporosis. Penolazzi *et al.* investigated the effects of *E. officinalis* fruit extracts on human primary osteoclasts and found that the extracts induced apoptosis in mature osteoclasts without affecting osteoclastogenesis[20]. This selective induction of programmed cell death in osteoclasts may offer a novel therapeutic approach to mitigate bone degradation associated with rheumatoid arthritis and prevent osteoporosis-related bone loss. Additionally, the growing demand for nutraceutical interventions in osteoarthritis management has prompted further exploration of *Amla*'s therapeutic potential. In this context, Sumantran *et al.*, reported that aqueous extracts of *Phyllanthus emblica* significantly inhibited hyaluronidase and collagenase type II activity in vitro, two key enzymes involved in cartilage degradation[21]. These findings support the potential chondroprotective role of *Amla* in osteoarthritis therapy and underscore its broader utility in bone health management.

4.7 Hepatoprotective

Amla has been widely recognized for its hepatoprotective properties, attributed primarily to its potent antioxidant and anti-inflammatory constituents, including vitamin C, flavonoids, and tannins. Several experimental studies have demonstrated its efficacy in protecting the liver against chemical and drug-induced hepatotoxicity, such as damage caused by carbon tetrachloride (CCl_4), paracetamol, and ethanol. Administration of *Emblica officinalis* Fruit Extract (EFE) at a dose of 250 mg/kg/day to alcohol-induced rats showed protective effects by reducing carbonyl content and lipid peroxidation, while simultaneously enhancing the activities of antioxidant enzymes, including SDH, NADH dehydrogenase, and cytochrome c oxidase. Additionally, it increases the content of cytochromes in hepatic mitochondria[22].

4.8 Dermoprotective

Over the past two decades, clinical and laboratory research has highlighted the advantages of various

natural ingredients in skin care. As a result, many of these compounds are now being explored, developed, or utilized not only for their anti-aging properties but also for their potential in treating dermatological conditions. *E. officinalis* extract is recognized for its potent antioxidant properties, which help protect human dermal fibroblasts from oxidative stress, making it beneficial for natural skin care. A study conducted by Fujii *et al*., demonstrated that *E. officinalis* extract stimulated proliferation of fibroblasts in a concentration-dependent manner. Besides, it also induced production of procollagen in a concentration- and time-dependent manner[23]. Conversely, matrix metalloproteinases (MMP)-1 production from fibroblasts was dramatically decreased, but there was no evident effect on MMP-2. These findings suggest that *E. officinalis* extract plays a role in collagen metabolism regulation, supporting its use in therapeutic, mitigative, and cosmetic applications. In ongoing research on plant-based cosmeceuticals, Majeed *et al*., showed that *E. officinalis* fruit extract effectively protects against ultraviolet-B-induced Reactive Oxygen Species (ROS) and collagen damage in normal human dermal fibroblasts[24]. *Amla* is widely used in hair care products such as oils, shampoos, and hair masks due to its rich vitamin C and antioxidant content, which help strengthen hair roots, reduce hair fall, prevent premature greying, and promote healthy hair growth. In one of the 12-week, controlled trials in 2024, *Amla* syrup significantly increased anagen-to-telogen hair for androgenic alopecia promoting hair growth by prolonging the anagen phase in Female Androgenic Alopecia (FAGA)[25].

4.9 Cerebroprotective / Anti-aging

Amla exhibits cerebroprotective effects, primarily due to its antioxidant and anti-inflammatory properties. It has been shown to protect against neurodegenerative conditions, reduce oxidative stress, and support cognitive function. Additionally, *Amla's* ability to modulate neurotransmitter systems and inhibit neuroinflammation offers potential therapeutic benefits for brain health. A study conducted by Dhingra D *et al.,* revealed that aqueous extract of *E. officinalis* (200 mg/kg) exhibited significant antidepressant-like effects in the tail suspension and forced swim tests, comparable to fluoxetine, imipramine, and phenelzine. Its action likely involves inhibition of MAO-A, GABA, and interaction with α1-adrenoceptors, dopamine D2 receptors, and serotonergic pathways, along with its antioxidant properties[26]. The active tannoid principles in *E. officinalis*, along with its antioxidant and Nitric Oxide (NO) scavenging properties, likely contributed to the observed protection against alcohol-induced brain mitochondrial dysfunction.

5. Challenges in Routine Incorporation of *Amla*

India is the largest producer of *Amla*, and it is cultivated across diverse agro-climatic regions. Despite *E. officinalis (Amla)* being widely cultivated and abundantly available across India, its regular incorporation into the daily diet or therapeutic use remains limited due to several challenges.

Amla has a distinct sour, astringent, and slightly bitter taste, which many people find unappealing for regular consumption in raw or natural form. This sensory barrier often deters its inclusion in daily diets, especially among children and the elderly[26]. Although *Amla* has been traditionally praised in *Ayurveda*, many people, especially in urban areas, are unaware of its full range of scientifically validated health benefits. Its image as a "traditional remedy" rather than a modern functional food affects its popularity among younger populations.

While *Amla* is widely grown, value-added products like *Amla* juice, candies, powders, or capsules are not uniformly accessible or affordable in rural and semi-urban markets. Poor marketing and distribution channels hinder its widespread adoption. Regional dietary practices and taste preferences play a significant role. In many parts of India, *Amla* is not traditionally used in daily cooking, and incorporating it into modern meals or recipes often requires behavioural change.

To promote the routine use of *E. officinalis (Amla)* and overcome the challenges of taste, accessibility, and familiarity, incorporating it into everyday recipes offers a practical and culturally acceptable solution. A variety of traditional and innovative preparations can make *Amla* more palatable and appealing across age groups. It can be easily included in the daily diet through diverse preparations like *Amla* juice, *Amla chutney*, *Amla chunda*, *Amla* pickle, addition to dals and *rasam*, dried

Amla candy, *Amla* in *mukhwas*, *Amla* raita, *Amla pulao*, *Amla sharbat*, and *Amla* coconut drink. These recipes not only retain *Amla*'s nutritional and therapeutic benefits but also align with Indian culinary preferences.

5. Conclusion

Emblica officinalis (*Amla*) exemplifies the synergy between traditional medicine and modern science. Rich in bioactive compounds, it exhibits diverse pharmacological effects, antioxidant, anti-inflammatory, immunomodulatory, and organ-protective properties. Evidence from clinical and preclinical studies supports its role in managing non-communicable diseases such as dyslipidemia, cardiovascular disorders, gastro-intestinal issues, neurodegeneration, and cancer, while also promoting general health. Despite its promise and wide cultivation in India, *Amla* remains underused due to sensory challenges, low awareness, and limited consumer-friendly formats. Public health initiatives, *Amla* integrated innovative products, and education can help in daily use. Thus, *Amla* is a validated, multi-targeted botanical with potential in preventive healthcare. Future research should clarify its mechanisms, optimize formulations, and conduct large-scale trials to fully realize its therapeutic value.

6. Author Contribution

Jitendra Lakhani and Varsha Shah: Conceptualization and supervision; Siddharth Thakkar, Meghana Patel and Shubham Darda: Literature review; writing, review and editing: Meghana Patel and Siddharth Thakkar. All authors have read and agreed to the published version of the manuscript.

7. References

1. Baliga MS, Dsouza JJ. *Amla* (*Emblica officinalis* Gaertn), a wonderberry in the treatment and prevention of cancer. Eur J Cancer Prev. 2011; 20(3):225-39. https://doi.org/10.1097/CEJ.0b013e32834473f4 PMID:21317655.
2. El-Desouky SK, Ryu SY, Kim YK. A new cytotoxic acylated apigenin glucoside from *Phyllanthus emblica* L. Nat Prod Res. 2007; 22(1):91-5. https://doi.org/10.1080/14786410701590236 PMID:17999342.
3. Doshi K, Nasim I. Evaluation of antioxidant property of three herbal formulations-an *in vitro* study. Int J Dent Oral Sci. 2021; 8(8):3596-600.
4. Dasaroju S, Gottumukkala K. Current trends in the research of *Emblica officinalis* (*Amla*): a pharmacological perspective. Int J Pharm Sci Rev Res. 2014; 24:150-9.
5. Ghosal S, Tripathi V, Chauhan S. Active constituents of *Emblica officinalis*. Part 1. The chemistry and antioxidative effects of two new hydrolysable tannins, emblicanin A (Ia) and B (Ib). ChemInform. 2010; 27. https://doi.org/10.1002/chin.199647279
6. Mahajan S, Bisht MS, Chakraborty A, Sharma VK. Genome of *Phyllanthus emblica*: the medicinal plant *Amla* with super antioxidant properties. Front Plant Sci. 2023; 14. https://doi.org/10.3389/fpls.2023.1210078 PMID:37727852. PMCID:PMC10505619.
7. Khurana SK, Tiwari R, Sharun K, Yatoo MI, Gugjoo MB, Dhama K. *Emblica officinalis* (*Amla*) with a particular focus on its antimicrobial potentials: a review. J Pure Appl Microbiol. 2019; 13(4):1995-2012. https://doi.org/10.22207/JPAM.13.4.11
8. Varnasseri M, Siahpoosh A, Hoseinynejad K, Amini F, Karamian M, Yad MJY, *et al*. The effects of add-on therapy of *Phyllanthus emblica* (*Amla*) on laboratory confirmed COVID-19 cases: a randomized, double-blind, controlled trial. Complement Ther Med. 2022; 65:102808. https://doi.org/10.1016/j.ctim.2022.102808 PMID:35093510. PMCID:PMC8799474.
9. Antony B, Merina B, Sheeba V, Mukkadan J. Effect of standardized *Amla* extract on atherosclerosis and dyslipidemia. Indian J Pharm Sci. 2006; 68(4):437-41. https://doi.org/10.4103/0250-474X.27814
10. Upadya H, Prabhu S, Prasad A, Subramanian D, Gupta S, Goel A. A randomized, double-blind, placebo-controlled, multicenter clinical trial to assess the efficacy and safety of *Emblica officinalis* extract in patients with dyslipidemia. BMC Complement Altern Med. 2019; 19(1):27. https://doi.org/10.1186/s12906-019-2430-y PMID:30670010. PMCID:PMC6341673.
11. Biswas T, Chakrabarti S, Pandit S, Jana U, Dey S. Pilot study evaluating the use of *Emblica officinalis* standardized fruit extract in cardio-respiratory improvement and antioxidant status of volunteers with smoking history. J Herb Med. 2014; 4. https://doi.org/10.1016/j.hermed.2014.09.002
12. Gopa B, Bhatt J, Hemavathi KG. A comparative clinical study of hypolipidemic efficacy of *Amla* (*Emblica officinalis*) with 3-hydroxy-3-methylglutaryl-coenzyme-A reductase inhibitor simvastatin. Indian J Pharmacol. 2012; 44:238-42. https://doi.org/10.4103/0253-7613.93857 PMID:22529483. PMCID:PMC3326920.
13. Patel SS, Goyal RK. Prevention of diabetes-induced myocardial dysfunction in rats using the juice of the *Emblica officinalis* fruit. Exp Clin Cardiol. 2011; 16(3):87-91.
14. Ojha S, Golechha M, Kumari S, Arya DS. Protective effect of *Emblica officinalis* (*Amla*) on isoproterenol-induced cardiotoxicity in rats. Toxicol Ind Health. 2012; 28(5):399-411. https://doi.org/10.1177/0748233711413798 PMID:22033422.

15. Bhandari PR, Kamdod MA. *Emblica officinalis* (*Amla*): a review of potential therapeutic applications. Int J Green Pharm. 2012; 6:257. https://doi.org/10.4103/0973-8258.108204
16. Sai Ram M, Neetu D, Yogesh B, Anju B, Dipti P, Pauline T, *et al*. Cyto-protective and immunomodulating properties of *Amla* (*Emblica officinalis*) on lymphocytes: an *in-vitro* study. J Ethnopharmacol. 2002; 81(1):5-10. https://doi.org/10.1016/S0378-8741(01)00421-4 PMID:12020921.
17. Mehmood MH, Siddiqi HS, Gilani AH. The antidiarrheal and spasmolytic activities of *Phyllanthus emblica* are mediated through dual blockade of muscarinic receptors and Ca^{2+} channels. J Ethnopharmacol. 2011; 133(2):856-65. https://doi.org/10.1016/j.jep.2010.11.023 PMID:21093572.
18. Yokozawa T, Kim S, Kim H, Tanaka T, Sugino H, Okubo T, *et al*. *Amla* (*Emblica officinalis* Gaertn.) attenuates age-related renal dysfunction by oxidative stress. J Agric Food Chem. 2007; 55:7744-52. https://doi.org/10.1021/jf072105s PMID:17715896.
19. Chen TS, Liou SY, Chang YL. Supplementation of *Emblica officinalis* (*Amla*) extract reduces oxidative stress in uremic patients. Am J Chin Med. 2009; 37(1):19-25. https://doi.org/10.1142/S0192415X09006680 PMID:19222108.
20. Penolazzi L, Lampronti I, Borgatti M, Khan MT, Zennaro M, Piva R, *et al*. Induction of apoptosis of human primary osteoclasts treated with extracts from the medicinal plant *Emblica officinalis*. BMC Complement Altern Med. 2008; 8:59. https://doi.org/10.1186/1472-6882-8-59 PMID:18973662. PMCID:PMC2587459.
21. Sumantran VN, Kulkarni A, Chandwaskar R, Harsulkar A, Patwardhan B, Chopra A, *et al*. Chondroprotective potential of fruit extracts of *Phyllanthus emblica* in osteoarthritis. Evid Based Complement Alternat Med. 2008; 5(3):329-35. https://doi.org/10.1093/ecam/nem030. PMID:18830448. PMCID:PMC2529383.
22. Reddy VD, Padmavathi P, Gopi S, Paramahamsa M, Varadacharyulu N. Protective effect of *Emblica officinalis* against alcohol-induced hepatic injury by ameliorating oxidative stress in rats. Indian J Clin Biochem. 2010; 25(4):419-24. https://doi.org/10.1007/s12291-010-0058-2 PMID:21966117. PMCID:PMC2994578.
23. Fujii T, Wakaizumi M, Ikami T, Saito M. *Amla* (*Emblica officinalis* Gaertn.) extract promotes procollagen production and inhibits matrix metalloproteinase-1 in human skin fibroblasts. J Ethnopharmacol. 2008; 119(1):53-7. https://doi.org/10.1016/j.jep.2008.05.039 PMID:18588964.
24. Mushtaq DA, Kaiser P, Satti NK, Zargar AM, Vishwakarma RA, Tasduq SA. Effect of *Emblica officinalis* (fruit) against UVB-induced photo-aging in human skin fibroblasts. J Ethnopharmacol. 2010; 132(1):109-14. https://doi.org/10.1016/j.jep.2010.07.047 PMID:20688142.
25. Akhbari M, Firooz A, Rahimi R, Shirzad M, Esmaealzadeh N, Shirbeigi L. The effect of an oral product containing *Amla* fruit (*Phyllanthus emblica* L.) on female androgenetic alopecia: a randomized controlled trial. J Ethnopharmacol. 2024; 318(Pt A). https://doi.org/10.1016/j.jep.2023.116958 PMID:37487962.
26. Dhingra D, Joshi P, Gupta A, Chhillar R. Possible involvement of monoaminergic neurotransmission in antidepressant-like activity of *Emblica officinalis* fruits in mice. CNS Neurosci Ther. 2012; 18(5):419-25. https://doi.org/10.1111/j.1755-5949.2011.00256.x PMID:22070517. PMCID:PMC6493501.
27. Goraya RK, Bajwa U. Enhancing the functional properties and nutritional quality of ice cream with processed *Amla* (Indian gooseberry). J Food Sci Technol. 2015; 52(12):7861-71. https://doi.org/10.1007/s13197-015-1877-1 PMID:26604358. PMCID:PMC4648887.