REVIEW ARTICLE

A Review of Amla Highlighting its Anti-oxidant Features

Sahara Shrestha¹, Rejina Shrestha², Pratibha Tripathi³, Kajal Jha⁴

¹ Assistant Professor and head, Department of Rasa Shastra Evam Bhaishajya Kalpana,  
²Assistant Professor, Department of Swasthayavritta, ³Assistant Professor, Department of Striroga  
and Prasuttantra, Ayurveda Campus Teaching Hospital, Tribhuvan University, Kathmandu,  
Nepal, ⁴Dental Surgeon, Kanti Children’s Hospital, Maharajgunj, Kathmandu, Nepal

ABSTRACT:

The role of reactive oxygen species and oxidative stress in bringing about a negative impact on health and providing an open invitation to a plethora of diseases is a well-known fact. This has led to the search of antioxidants. The number of conventional available antioxidants have certain limitations and researchers are constantly in search of herbs and medicinal plants. Amla possesses a wide range of medicinal values used ardently by our seers for the treatment of the diseased and to maintain the health of the healthy people as well. Researches have thrown light upon the fact that Amla possesses anti-oxidative features and has a wide range of therapeutic utilities. The antioxidant property of Amla has been even experimented to offer a readily available alternative in certain cases as well. The scattered information pertaining to the antioxidant potential of Amla in Ayurveda and contemporary science is reported. Present review embraces the general introduction, morphology, phytochemical and pharmacological attributes and an in-depth information of reported antioxidant properties of Amla in terms of available experimental and clinical studies.

Keywords: Amla, Antioxidant, Rasayana, Rejuvenator, Ayurvedic herb.

INTRODUCTION

Amla (Emblica officinalis) colloquially known as Indian Gooseberry, is a highly potent herb used in Ayurveda. According to belief in Indian mythology, Amla is the first tree to be created in the universe; which belongs to the family of Euphorbiaceae. Euphorbiaceae is one of the largest families of flowering plants, composed of over 300 genera with 8,000 species and 5 subfamilies worldwide habituating preferentially in tropical and subtropical environment. The family is very diverse in range, composed of all sorts of plants ranging from large woody trees through climbing lianas to simple weeds that grow prostrate to the ground. Members are widely distributed all around the world constituting both old world and new world plants some of which are yet to be identified. The family consists of species of great economic importance like Ricinus communis L. (Eranda), Manihot esculenta Crantz (cassava), Croton tiglium (Jayapat) and Hevea brasiliensis Wild. Ex. A. Juss (rubber tree) among others and also weeds like Euphorbia esula L. and Euphorbia maculata L. The implication of this is that Euphorbiaceae is a complex family with a lot of research potential. Several anatomic features like wood structure, laticifer type, trichomes and nature of stomata are important for family classification, while others like pollen nuclear numbers, exine structures,
type of pollination and inflorescence types are important for classifying its genera, tribes and subfamilies.¹

_Amla_ is native to India and also grows in tropical and subtropical regions of Nepal, Pakistan, Uzbekistan, Sri Lanka, South East Asia, China and Malaysia.² Most parts of the plant comprising the fruit, seed, leaves, root, flowers and bark are utilized in both dried and fresh structure.³ _Amlak_ possesses key properties like _Rasayana_ (adaptogenic), _Ajura_ (anti-ageing), _Ayushprada_ (prolonging lifespan because of its noteworthy restorative and nutritive qualities), _Amrit phal_ (life-giving fruit), _Sandhaniya_ (improves cell migration and cell binding) and _Kantikara_ (improvement in complexion).⁴ _Amlak_ is one of the most potent and nutritious drugs and also the best rejuvenating herb (Amalaki Vayasthapnamam Shreshtham).⁵ Acharya Charaka has classified it under the following categories: _Kustaghna_ (alleviates skin disorders), _Virechanopaga_ (adjuvant in purgative therapy), _Kasahara_ (bronchial sedative), _Jwarahara_ (anti-pyretic) and _Vayasthapaka_ (rejuvenator).⁶

_Amlaki_ has low molecular weight hydrolysable tanins (emblicanin A and B) thereby it is considered as one of the stronger antioxidant herb in Ayurveda.⁷ _Amla_ is highly nutritious and is one of the richest sources of vitamin-C, amino acids and minerals.⁸ Its fruit juice contains the highest concentration of vitamin-C (478.56mg/100mL). Vitamin C levels in it are more than in oranges, tangerines and lemons.⁹,¹⁰

**Vernacular names**¹¹

<table>
<thead>
<tr>
<th>Arabic</th>
<th>Ambily, Amlaj</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assam</td>
<td>Amlaki, Amluki, Sohmyrlain</td>
</tr>
<tr>
<td>Bengal</td>
<td>Ambolati, Amla, Amalaki, Amlati, Amulati, Aunlai, Yeonlai</td>
</tr>
<tr>
<td>Bombay</td>
<td>Amla, Avala, Avalkati</td>
</tr>
<tr>
<td>Burma</td>
<td>Hziphyu, Shabju, Siphiyusi, Tasha, Zibyu, Ziphiyusi</td>
</tr>
<tr>
<td>Cambodia</td>
<td>Ngop</td>
</tr>
<tr>
<td>Canarese</td>
<td>Amalaka, Chattu, Dadi, Dhanya, Dhatri, Nelli, Sudhe</td>
</tr>
<tr>
<td>Central Provinces</td>
<td>Amla, Anla</td>
</tr>
<tr>
<td>Ceylon</td>
<td>Toppinelli</td>
</tr>
<tr>
<td>Chinese</td>
<td>An Mo Le</td>
</tr>
<tr>
<td>Cuttack</td>
<td>Alathanda</td>
</tr>
<tr>
<td>Deccan</td>
<td>Amla, Owla, Ownla</td>
</tr>
<tr>
<td>English</td>
<td>Emblic myrobalan tree</td>
</tr>
<tr>
<td>Garo</td>
<td>Ambari</td>
</tr>
<tr>
<td>Gond</td>
<td>Aunri, Lalla, Milli, Nalli, Nilli, Usir</td>
</tr>
<tr>
<td>Gujarati</td>
<td>Amali, Ambala, Ambri, Amla, Bhoza, Bhozaamall</td>
</tr>
<tr>
<td>Hindi</td>
<td>Amalic, Amla, Amlika, Aonla, Anuli, Anvula, Anvurah, Anwerd, Anura, Aungra, Daun</td>
</tr>
<tr>
<td>Khond</td>
<td>Durga</td>
</tr>
<tr>
<td>Kol</td>
<td>Miral</td>
</tr>
<tr>
<td>Kolami</td>
<td>Aura</td>
</tr>
<tr>
<td>Konkani</td>
<td>Anvallo, Dogranvalli, Dogranvallo</td>
</tr>
<tr>
<td>Kumaon</td>
<td>Aonlai</td>
</tr>
<tr>
<td>Kurku</td>
<td>Aunre</td>
</tr>
<tr>
<td>Kwang Tung</td>
<td>YeouKanTsc</td>
</tr>
<tr>
<td>Lambadi</td>
<td>Ambla</td>
</tr>
<tr>
<td>Lepcha</td>
<td>Amlokung, Suom</td>
</tr>
<tr>
<td>Malayalam</td>
<td>Amalakam, Nelli</td>
</tr>
<tr>
<td>Marathi</td>
<td>Anvala, Aonli, Avala, Arola, Bhuiawali</td>
</tr>
<tr>
<td>Nepali</td>
<td>Amla</td>
</tr>
<tr>
<td>North western</td>
<td>Amla, Aoula Provinces</td>
</tr>
<tr>
<td>Persian</td>
<td>Amelah, Amulch</td>
</tr>
<tr>
<td>Portuguese</td>
<td>Mirabolano emblico</td>
</tr>
<tr>
<td>Punjab</td>
<td>Ambal, Ambli, Ambul, Amla, Aonla</td>
</tr>
<tr>
<td>Sanskrit</td>
<td>Adiphala, Akara, Amalaki, Amamalakam, Amlika, Amraphala, Amrita, Amritaphala, Bahuphali, Dhatri, Dhatrika, Dhatriphala, Jatiphala, Tishya, Tishyaphala</td>
</tr>
<tr>
<td>Santal</td>
<td>Meral</td>
</tr>
<tr>
<td>Saora</td>
<td>Peddavusirika</td>
</tr>
<tr>
<td>Sinhalese</td>
<td>Awusadanelli, Nelli, Nellika</td>
</tr>
<tr>
<td>Tamil</td>
<td>Amalagam andakoram, Indul, Kattunelli, Nelli, Perunelli, Sirottam, Tattiri</td>
</tr>
<tr>
<td>Telugu</td>
<td>Amalakamu, Amalaki, Nelli, Pullayusirika, Usirika, Usiriki</td>
</tr>
<tr>
<td>Tulu</td>
<td>Nelli</td>
</tr>
<tr>
<td>Urdu</td>
<td>Anwala</td>
</tr>
<tr>
<td>Uriya</td>
<td>Khondona, Onola</td>
</tr>
</tbody>
</table>
Propagation

*E. officinalis* is one of the preferred species for small-scale or marginal-farm-based agro-forest industries in multiple tropical and sub-tropical countries, owing to its high nutraceutical factors and its versatility to be processed into a wide range of pharmaceutical products. These days, it is cultivated as a street or park tree and is an essential component of gardens and orchards at both local and regional levels for its myriad dietary, culinary and medicinal benefits. For optimum growth and development of *E. officinalis* tree, 630–800 mm annual rainfall is most favourable and it can thrive up to 46°C since the warm climate is quite advantageous during the onset of its fruit growth. A seedling tree takes 6–8 years to initiate fruit and a budded/grafted tree starts fruit bearing after 3 years of planting, but the latter may keep on fruiting up to 60–75 years of age. Managing an *E. officinalis* orchard includes looking after the nutrient and water supply, maintenance of canopy architecture, field cleanliness and taking plant protection measures on time. The plant needs to be protected from hot winds during summer in dry regions and from frost during winter. Many aspects need to be taken in consideration like irrigation, hoeing, weeding, soil conditions, pH, mulching and pruning etc. for better growth and harvest.

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. The average girth of the main stem is 70 cm. Leaves are 10 -13 mm long, 3 mm wide, closely set in pinnate which makes the branches feathery in appearance. Flowers are unisexual, 4 to 5 mm in length, pale green in colour, 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.

Description of Amalaki

A deciduous small or middle-sized tree with crooked trunk and spreading branches; bark greenish grey, peeling off in conchoidal flakes; branchlets glabrous or finely pubescent, 10-20 cm long, often deciduous. Leaves subsessile, 10-13 by 2.5-3 mm, closely set along the branchlets, distichous, light green, glabrous, narrowly linear, obtuse, imbricate when young, having the appearance of pinnate leaves; stipules ovate, finely acute. Flowers greenish yellow, in axillary fascicles on the leaf-bearing branchlets, often on the naked portion below the leaves, with fimbriate bracts at the base. Male flowers numerous, on short slender pedicles. Sepals 6, oblong, obtuse, 1.2 mm long. Anthers 3 on a short central column. Female flowers few and subsessile. Sepals as in the male. Disk a lacerate cup. Ovary 3 celled; styles connate at the base, irregularly twice 2-fld with acute lobes. Fruit 1.3-1.6 cm diameter, fleshy globose with 6 obscure vertical furrows, pale yellow, of three 2 seeded crustaceous cocci. Seeds 6, 3 gonous.

MATERIAL AND METHODS:

Published information from several articles, of which few review articles and cross-references were collected. Recent developments in antioxidant studies on *Amla*, covering all available records and articles in Pubmed, Scopemed and other databases including fields of pharmacology, biomedicine and health were also rationally reviewed and taken into study for the report. The search criteria were restricted to the roles of *Amla* as an antioxidant in light of published experimental and clinical outcomes in this regard.

Description/Observation:

Phytochemical Attributes

Ascorbic acid (vitamin C) is the most abundant constituent of the fruit. Besides this, other phytochemicals isolated from this plant include fixed oils, phosphatides, essential oils, tannins, minerals, vitamins, amino acids, fatty acids, glycosides etc. Fatty acids reported include linolenic, linoleic, oleic, stearic, palmitic and myristic acids. D-glucose, D-fructose, D-myoinositol, D-galacturonic acid, D-arabinosyl, D-ramnosyl, D-xyllosyl, D-glucosyl, D-mannosyl and D-galactosyl residues are the sugars. Emblican A and emblican B, pedunculagin and punigluconin are the major tannins reported from this plant.

Other compounds isolated from this plants are gallic acids, amlaic acid, arginine, aspartic acid, astragallin, β-carotene, β-sitosterol, chebulagic acid, chebulic acid, chebulagic acid, chebulinic acid, corilaginic acid, corilagin, cysteine, ellagic acid, embilicol, giberrellins, glutamic acid, glycone, histidine, isoleucine, kaempferol, leucodelphinidin, methionine, phenylalanine, phyllantidine, phylemblic acid, quercetin, riboflavin, rutin, thiamin, threonine, tryptophan, tyrosine, valine, zeatin etc.
Pharmacological Attributes

Pharmacological research reports on Amla reveal its analgesic, anti-tussive, anti-atherogenic, adaptogenic, anti-diabetic, cardio, gastro, nephro, neuro protective and anticancer properties. Amla is also reported to possess chemopreventive, radioprotective, chemo and immunomodulatory, free radical scavenging, antioxidant, anti-inflammatory, and anti-mutagenic activities. Immunomodulating agents that are free from adverse reactions and those that can be administered for long duration, if possible throughout life, to obtain a continuous immune activation are highly desirable for the prevention of diseases. The significance of the Rasayanas as immunomodulating agents compared to other conventional immunomodulators is that they activate the immune function without altering the other basic parameters of the body. Amla belonging to this Ayurvedic class of Rasayana, may pose as a superior herb for activating, replenishing and maintaining the immunity of the body.

Action and Uses

The root bark is astringent and is useful in ulcerative stomatitis and gastric ulcer. The bark is astringent and useful in gonorrhea, jaundice, diarrhea and myalgia. The flowers are cooling and aperients. The leaves are useful in conjunctivitis, inflammation, dyspepsia, diarrhea and dysentery. The fruits are astringent, cooling, anodyne, carminative, digestive, stomachic, laxative, alterant, astringent, aphrodisiac, diuretic, antipyretic, tonic and trichogenous. They are useful in diabetes, cough, asthma, bronchitis, headache, ophthalmic disorders, dyspepsia, colic, flatulence, hyperacidity, peptic ulcer, erysipelas, skin diseases, leprosy, hematemesis, inflammations, anaemia, emaciation, hepatic disorders, jaundice, strangury, diarrhoea dysentery, intrinsic haemorrhages, leucorrhoea, menorrhagia, cardiac disorders, intermittent fever and greyness of hair. Seeds are reported to be useful in asthma, bronchitis and biliousness.

Ayurvedic Pharmacopoeia of India has also cited its properties and actions

Rasa : Madhura, Amla, Katu, Tikta, Kashaya
Gunna : Laghu, Rukshya
Vritya : Shita
Vipaka : Madhura
Karma : Tridoshajit, Vrshya, Rasayana, Cakshushya

Antioxidants

Antioxidants are molecules that help combat the damaging effects of free radicals in the human body. Antioxidants are found in certain foods and may prevent some of the damage caused by free radicals by neutralising or scavenging them. Free radicals are highly unstable molecules that are naturally formed or triggered by metabolism, physical activities, stress or environmental sources such as cigarette smoking, alcohol, air pollution, sunlight and other factors.

The reactive oxygen species have useful cellular functions, such as redox signalling and help in effective functioning of the body. The immune cells use free radicals to fight infections. When free radicals outnumber antioxidants, it can lead to a state called oxidative stress, a process that can trigger cell damage. Oxidative stress is thought to play a role in a variety of diseases including cancer, cardiovascular diseases, diabetes, Alzheimer’s disease, Parkinson’s disease and eye diseases such as cataracts and age-related macular degeneration. Free radicals are highly reactive compounds that attack molecules by capturing electrons and change the chemical structures of the moieties. The free radicals can cause harm if their levels become too high in the body which expose humans to multiple illnesses. Free radicals like hydroxyl radicals can damage cell membrane and lipoproteins by lipid peroxidation which may result in early ageing. So, a balance of free radicals and antioxidants needs to be maintained. Antioxidants including certain enzymes, Vitamin C, Vitamin E and beta carotene can combat the harmful effects of oxidation. Some compounds contribute to antioxidant defence by chelating transition metals and preventing them from catalysing the production of free radicals in the cell. In general, antioxidant systems prevent the formation or aid in removal of these reactive species to help maintain the level of the free radicals at an optimum level. Antioxidants scavenge these free radicals once they tend to increase in quantity in the body cells and prevent or reduce the damage caused by oxidation.

Antioxidant Attributes

Amla is one of the richest sources of vitamin-C and low molecular weight hydrolysable tannins which makes Amla a good antioxidant. It acts as an antioxidant by acting on one of the pathways of free radical scavenging, scavenging superoxide, hydroxyl radical & other reactive oxygen
species, metal ion chelation, prevention of lipid peroxidation or DNA damage.

The tannins of Amla like emblican-A (37%), emblican-B (33%), punigluconin and pedunculagin are reported to provide protection against oxygen radical included haemolysis of rat peripheral blood erythrocytes. The mechanism behind antioxidant activity is due to 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 repair the chromosomal abnormalities. Tannoids from Amla were found to have anti-stress activity. They normalize levels of Superoxide dismutase (SOD), GPX and Catalase (CAT) activity in a rat model. In brain cells, Amla has high antioxidant activity. Renal injury occurs when reactive oxygen species exceed the antioxidant reserve of renal tissue. Amla contains high concentrations of antioxidants ascorbic acid, gallic acid and phenolic compounds suggesting its antioxidant activity may be beneficial for the prevention of age-related renal disease and improvement of urinanalysis parameters. Also, Amla extracts are reported to have the ability to modulate basal oxidative markers and enhance endogenous antioxidant defence in a hepatocyte cell line (HepG2). These all studies provide further evidence to the role of Amla at a cellular level.

Studies have also shown that quercetin, an important phytochemical of Amla protects human hepatocytes from ethanol-derived oxidative stress by inducing heme oxygenase-I via the MAPK/Nrf2 pathways. Mechanistic studies showed that Amla extract was effective as an iron chelator, to reduce ferrous ion-mediated DNA breakdown, increase the levels of antioxidant enzyme and decrease the reductive release of ferritin iron. Together all these observations clearly indicate the usefulness of Amla in reducing the iron load-induced liver damage. Also, the extract of leaves of Emblica officinalis is found to exert rapid protective effects against lipid peroxidation by scavenging free radicals and reducing the risk of diabetic complications.

A study was performed in mice thymocytes to evaluate the protective effect of Amla against oxidative stress and apoptosis induced by arsenic. Arsenic exposure to mice caused a significant increase in the lipid peroxidation, ROS production and decreased cell viability, levels of reduced glutathione, the activity of superoxide dismutase, catalase, cytochrome c oxidase and mitochondrial membrane potential in the thymus as compared to controls. Co-treatment of arsenic and Amla extract reversed the causes which are developed during arsenic exposure only. It decreased the levels of ROS production and increased lipid peroxidation, caspase-3 activity, cytochrome c oxidase, mitochondrial membrane potential and levels of antioxidant enzymes as compared to only arsenic treated mice.

Subsequent studies have affirmed that Amla was effective in reducing alcohol-induced hepatotoxicity. The investigators observed that when compared to the alcohol-alone cohorts, the elevated liver enzymes (AST, ALT, ALP and GGTP) following chronic intake of alcohol were effectively normalised by Amla intake. Also, the levels of carbonyl content, lipid peroxidation and nitric oxide are reduced, thus restoring the levels of SDH, NADH dehydrogenase, cytochrome C oxidase and cytochromes, thereby suggesting its usefulness in preventing alcohol-induced hepatic damage.

E. Officinalis can inhibit mutations in genes and repair the chromosomal abnormalities.

The antioxidant activity of Emblica officinalis tannoid containing punigluconin, pedunculagin emblican A and emblican B were examined. The results were compared with deprenil induced effects, a well-recognised antioxidant activity. Doses of 10 and 5 mg/kg of active tannoids with deprenil encouraged an increase in striatal as well as frontal cortical Superoxide dismutase, catalase and Glutathione peroxidase activity, associated with the reduction in lipid peroxidation. The study also designate that the antioxidant activity may exist in the tannoids of E. officinalis, which have vitamin C-like properties.

In hepatocyte cell lines, E. officinalis extracts showed its effects on cellular oxidative state, causing decrease in ROS and lipid hydroperoxide. The result evidently designates the tendency of aqueous extracts of E. officinalis in improving the endogenous antioxidant defences in hepatocytes.

The fruit extract ameliorative effect on plasma biochemical profile caused by oxidative changes induced by alcohol in rats was examined. Administration of alcohol caused increase in the level of creatinine, total bilirubin, lipid as well as lipoproteins and plasma nitrite/nitrate. Furthermore, extract administration with dose of 250 mg/kg body wt/day to rats
with alcohol-supplemented considerably controlled plasma lipids as well as lipoprotein patterns and also decreased creatinine and nitrite/nitrate levels. Besides, extract given rats caused a noteworthy enhancement in the uric acid levels, total plasma protein and A/G ratio.\textsuperscript{54}

In a study, compared to the free and bound phenolics of curcumin; the free and bound phenolics of \textit{Emblica officinalis} showed 4–10 times high antioxidant activity levels, assessed by scavenging free radicals and reducing power assays. Higher level of antioxidant activity in \textit{E. officinalis} has been attributed to the phenolic content (12.9\%, w/w, correlation coefficient R = 0.74) in them. Phenolic content in \textit{E. officinalis} has been attributed in higher level of antioxidant activity.\textsuperscript{55} These results help to establish \textit{Amla} as a better and more potent priority when it comes to the selection of a natural antioxidant.

The use of various forms of \textit{Amla} for oral hygiene and health is also extensive. The juice extract of \textit{Amla} is put in ear to find relief from toothache. A decoction of leaves of \textit{Amla} is used as a bactericidal mouthwash. The root bark is mixed with honey for treating aphthous stomatitis.\textsuperscript{56} Recently, it has been shown that reduced enamel-orthodontic bracket bond strength following bleaching is reversed with the use of sodium ascorbate as an antioxidant.\textsuperscript{57} Thus, the main purpose of antioxidant treatment of the teeth post bleaching is to eliminate any residual oxygen trapped inside the dental hard tissues, thereby helping to neutralize the oxidizing effects of the bleaching agent.\textsuperscript{58} A study was conducted to bring about the antioxidant role of \textit{Amla} in reversing the phenomena. According to the results obtained, treatment of the bleached teeth with gooseberry did significantly increase their SBS, but it did not match the level of bond strength obtained after treatment with sodium ascorbate. Hence, in the comparison of the efficacy of sodium ascorbate and gooseberry in reversing the compromised bond strength after bleaching, sodium ascorbate proved to be a better alternative.\textsuperscript{59} \textit{Amla}, with its antioxidant virtue could be used alternatively, to increase the enamel-orthodontic bracket bond strength in such cases related to dental practice.

\textit{Amla} inhibits the growth and spread of various cancers like breast, uterus, pancreas, stomach and liver cancers.\textsuperscript{50,61} It can prevent and/or reduce the side effects of chemotherapy and radiotherapy. More than 18 compounds were identified in \textit{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.\textsuperscript{62}

Recent studies suggest that \textit{Amla} intake may increase plasma antioxidant potential and decrease oxidative stress, which can help promote oxidative homeostasis. All of these benefits are possible without influencing hepatic or renal function, or diabetic indices in healthy humans. Lastly, the results from the human clinical study conclusively established that \textit{Amla} has an acceptable sensory and safety profile while providing enormous potential for the management of a healthy lifestyle.\textsuperscript{63}

Recent researches have shown that \textit{Amalaki Rasayana}, a composition chiefly constituting of \textit{Amla}, maintains telomere length by increasing the activity of telomerase which is responsible for ageing.\textsuperscript{64} The study has affirmed the use of \textit{Amla} as a natural agent to control or retard ageing to a certain limit and further supported its role as the best \textit{Vayasthapaka}(rejuvenator) as stated in the Ayurveda literature.

**DISCUSSION**

Current review outlined various evidences which indicated that it had an extended chain antioxidant effect. The prolonged use of its various dosage forms may prove beneficial over chemical or synthetic drugs in delimitating, alleviating or even reversing some of the chronic manifestations and complications caused by the accumulation of free radicals and their subsequent complexities.

\textit{Amla} has been used in various forms in Ayurveda for treating a wide array of diseases. It has been advocated as the best \textit{Vayasthapaka} (rejuvenator). \textit{Vayasthapaka} drugs help to revitalise the worn-out tissues and cells, maintain a youthful appearance with a better skin lustre and may also promote in regeneration and healing of tissues. It helps in fixing the exhausted cell biology and maintaining an optimum equilibrium of good health. The concept of \textit{Rasayana} deals with the promotion of longevity, enhancing memory, intelligence, glow and lustre of skin, tolerance, adaptogenic, nootropic as well as neuroprotective properties. All of these qualities may work individually or synergistically to help in projecting the effects of consuming the drugs or their formulations. The researches have affirmed similar actions of \textit{Amla} that may have helped it in showing its enormous
effects as an antioxidant and improving the quality of life. Amla, taken over a long interval of time, may bring out an exponential positive change to help in retard ageing, cope with various diseases and build a better immune system. The antioxidant effect of Amla is needed to be studied further in healthy humans as well to better understand the health promoting mechanism.

Amla possesses multiple target actions that obliterate the composite pathway that arise due to the free radical increment, lipid peroxidation and oxidative stress. It may be able to block and delay oxidative stress and in turn retard geriatric symptoms and hence may have been used as an anti-ageing drug by our seers. It may be incorporated as an integral part of our diet in its natural form or formulated and used as a supplementary food, ophthalmic product or even cosmetic product for revitalising skin, hair etc.

Although evidence from recent studies persistently support the antioxidant claims of Amla, multi-centric large scale clinical trials of both disease specific and healthy individuals need to be progressively conducted to know about the cause-effect relationship, actual mechanism of action, safety and interaction with other drugs. The present review warrants more qualitative and quantitative studies for the isolation, characterisation of bioactive products to showcase a definite pathway as well as range of antioxidant properties exhibited by Amla and subsequent studies of pharmacokinetics and pharmacodynamics of formulations of Amla as mentioned in Ayurvedic literature. The easy availability of Amla and the magnitude of benefits present in this herb and plenty of textual references of its formulations demonstrate its potential as a great antioxidant herb and recent contemporary researches have further strengthened its role.

**Future Scope**

Amla must be thoroughly investigated in both healthy and diseased persons in the wake of ethno medicinal usages. Studies of Amla on true dose response relationship, multiple pharmaco-dynamic targets and probable mode of action on various systems remain to be established. It can also be used as a supportive or supplemental drug with other synthetic drugs as an adjuvant, to enhance their activity and to alleviate their possible side effects. Future trials with similar antioxidant herbs should be encouraged. More in vivo and in vitro investigations should be encouraged in order to validate the antioxidant activity. Present review strongly emphasizes the optional and rational uses of traditional herbal medicines in this regard.

**CONCLUSION**

Present review highlights the classical claims of Amla and their validation by contemporary researches. Evidences from reported studies suggest its multi-faceted antioxidant effects via many pathways of action. Amla and analogous potent herbs provide better alternatives as a potential antioxidant which are easily available and affordable to the general public.

**ACKNOWLEDGEMENT** : The authors would like to express sincerest gratitude to the researches whose works have been mentioned.

**ABBREVIATIONS** : Not Applicable

**SOURCE OF SUPPORT** : None

**CONFLICT OF INTEREST** : Author declares that there is no conflict of interest.

**REFERENCES** :


9 Jain SK, Khurdiya DS, Vitamin C enrichment of fruit juice based ready-to-serve beverages through blending of Indian gooseberry (Emblica officinalis) juice, Plant Foods for Human Nutrition. 2004; 59(2): 63-6.


38. PC Sharma, MB Yelne, TJ Dennis, Database on medicinal plants used in Ayurveda, Vol-3, CCRAS, Dept. of ISM & H, Min. of Health & Family Welfare, Govt. of India, reprint 2005, p. 12.


55 Kumar GS, Nayaka H, Dharmesh SM, Salimath PV. Free and bound phenolic antioxidants in amla (Emblica officinalis) and turmeric (Curcuma longa). J Food Compos Anal 2006,19 (5); 446–457.


How to cite this article: