



Review Paper

## Role of Amla in Type 2 Diabetes Mellitus - A Review

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### Abstract

*Embolica officinalis* (Amla) is widely used in the Indian system of medicine and believed to increase defense against diseases. The Amla is known for its therapeutic properties and holds a reputed position in the ayurvedic and unani system of medicine in the country. The biological effect of Amla has been attributed to the antioxidant properties of the low-molecular hydrolysable tannins present in the fruit. Amla is the richest source of Vitamin C and contains gallic acid, ellagic acid and flavonoids. The galleoellagi tannins in the fruit preserve the vitamins under all conditions. Amla possesses antioxidant, ant hyperglycemic and antihyperlipidemic properties. The present review, deals with nutritive value of Amla, chemical composition, medicinal properties and use of amla in improving Blood Glucose metabolism in Type 2 Diabetes Mellitus have been discussed to provide collective information. Amla, being the polyphenols and a mixture of phytochemicals can act as a hypolipidemic agent reducing the risk of cardiovascular complications in diabetics. Thus amla may be used as a supportive therapy for diabetics.

**Keywords:** Amla, nutrition value, diseases, medical properties and diabetes.

### Introduction

Amla is used in Indian medicine for the treatment of various diseases, scientifically known as *Embolica officinalis* (Eo) or *Phyllanthus emblica*. Amla is a member of the small genus of *Embolica* (Euphorbiaceae). It grows in tropical and subtropical parts of India, Sri Lanka, China, Indonesia and the Malay Peninsula<sup>1</sup>. Amla fruits, also known as Indian gooseberry, are acid, cooling, diuretic and laxative.

The fruits are useful in diabetes, bronchitis, hyperacidity, peptic ulcer, dermatitis, haematogenesis, inflammations, anemia, liver diseases, gastrointestinal tract disorder, menorrhagia and cardiac disorders. Being exceptionally rich in vitamin C, amla is vital for treatment of human scurvy<sup>2,3</sup>.

The amla pulp is contains 600 mg of vitamin C per 100 g and nearly twenty times as that of orange juice. The amla contains a chemical substance which prevents the oxidation of the vitamin present in it. Therefore, amla is providing a good supply of vitamin C in the fresh as well as the dry condition<sup>4</sup>. The nutritive value of amla is given in Table-1.

### Identification and Chemical Constituents of amla

Tannins, alkaloids and phenolic compounds are constituents of amla. It has been reported that 100 ml of amla juice contains 478.56 mg of vitamin C (5). A new acylated apigenin glucoside was isolated from the methanolic extract of the leaves of *Phyllanthus emblica* (Amla) (6). The chemical constituents of Amla are shown in figure-1.

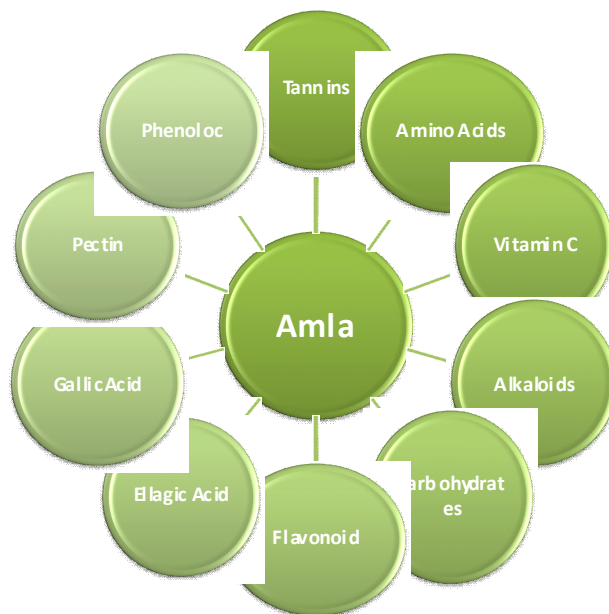
### Pharmacological and Medicinal properties

Amla has revitalizing effects, as it contains an antiageing element, it improves maintains immunity and strength in old age. It improves body resistance and protects the body against infections<sup>7</sup>. Intervention with ethyl acetate (EtOAc) extract of Amla resulted in decreasing the raised levels of urea Nitrogen and serum creatinine, thereby increasing the hepatic antioxidant system and reducing cytotoxic products<sup>8</sup>. The antioxidant activity of Amla extract is associated with the presence of hydrolysable tannins possessing like vitamin C. it can be concluded that Amla plays a role in reducing oxidative stress and improving glucose metabolism in type-2 diabetes mellitus<sup>9,10</sup>.

Table-1  
Nutritive value per 100g of amla

Components	Amount
Protein (g)	0.5
Energy (Kcal)	58 1
Vitamin A (I.U.)	151
Carotene (µg)	9
Calcium (mg)	50
Iron (mg)	1.2
Phosphorus (mg)	20
Fiber (g)	3.4
Vitamin C (mg)	600

Source: National Institute of Nutrition (2004)



**Figure-1**  
**Chemical constituents found in amla:**

Experimental work done in human subjects has shown the beneficial effect of amla. Subjects receiving amla have shown significant reduction in mean serum cholesterol level<sup>11,12</sup>. The result of amla supplementation on total serum cholesterol and its lipoprotein fractions in normal and hyper cholesterolaemic men aged 35-55 years a decrease in cholesterol levels<sup>13</sup>.

The effects of chronic oral administration of fresh fruit homogenate of amla on myocardial antioxidant system and oxidative stress induced by ischemic-reperfusion injury (IRI) were investigated in rats. Chronic EO administration produces myocardial adaptation by augmenting endogenous antioxidants and protects rat hearts from oxidative stress associated with IRI<sup>14</sup>.

*Emblica officinalis* inhibits chromium-induced free radical production, and it restores the antioxidant status<sup>3</sup>. Restoration of antioxidant levels and inhibition of Cr- induced free radical production can be achieved by Amla<sup>15,16</sup>.

Amla fruits have been reported to be used for hepatoprotection in Ayurveda<sup>17</sup>. *Phyllanthus emblica* extract was investigated on ethanol induced rat hepatic injury. Protective roles of amla against ethanol induced liver injury in rats have been reported<sup>18</sup>.

It was observed that the extract of *Emblica officinalis* inhibited the hepatotoxicity produced by CCl administration. Chronic CCl<sub>4</sub> administration was also found to produce liver fibrosis as seen from the increased levels of collagen-hydroxyproline and

pathological analysis. *Emblica officinalis* extract was found to inhibit these elevated levels significantly, showing that the extract could reduce the induction of fibrosis in patients<sup>19</sup>.

Phytochemicals is presently being considered as effective chemopreventive agents. Tannins and flavonoids, uniquely present in Amla, possess and exhibit potent antioxidant properties<sup>20</sup>. Inhibition of carcinogenesis at various stages can be achieved by phenolic compound obtained from plant<sup>21</sup>.

### Uses of Amla in Diabetes

Diabetes Mellitus is a chronic, potentially debilitating disease. The prevalence of Non Insulin Dependent Diabetes Mellitus is increasing in all populations worldwide. India leads the world with largest number of diabetic subjects earning the dubious distinction of being termed the "diabetes capital of the world". Diabetes is a chronic disorder of carbohydrate, fat and protein metabolism characterized by increased fasting and post prandial blood sugar levels<sup>22</sup>. The number of people with diabetes is increasing due to population growth, aging, urbanization, and increasing prevalence of obesity and physical inactivity. Traditional Medicines derived from medicinal plants are used by about 60% of the world's population. Indian herbal drugs and plants are used in the treatment of diabetes, especially in India<sup>23</sup>.

Amla forms an integral part of the Indian system of medicine and is effective in prevention of diabetes mellitus and other

diseases. Research concludes that amla supplement is effective in reducing the Fasting and Post Prandial blood glucose levels and HbA1c levels<sup>24,25</sup>. The tannoids of *E. officinalis* are potent inhibitors of Aldose Reductase (AR) and suggest that exploring the therapeutic value of natural ingredients that people can incorporate into everyday life may be an effective approach in the management of diabetic complications. Emblica and its tannoids might counter the polyol pathway-induced oxidative stress as there was a reversal of changes with respect to lipid peroxidation, protein carbonyl content, and activities of antioxidant enzymes. Emblica also prevented aggregation and insolubilization of lens proteins caused by hyperglycemia<sup>26</sup>. Aldose reductase plays a role in the development of secondary complication of diabetes including cataract. Amla inhibits of aldose reductase and has antihyperglycemic properties<sup>27</sup>.

Amla due to its high vitamin C content is effective in controlling diabetes. A tablespoon of its juice mixed with bitter gourd juice, taken daily for two months will stimulate the pancreas and enable it to secrete insulin, thus reducing the blood sugar in the diabetes. Diet restrictions should be strictly observed while taking this medicine. It will also prevent eye complication in diabetes<sup>28</sup>.

The capacity of tannins to enhance glucose uptake and inhibit adipogenesis, makes them potential drugs for the treatment of non-insulin dependent diabetes mellitus. One of the therapeutic approaches for decreasing postprandial hyperglycemia is to prevent or delay absorption of glucose by the inhibition of carbohydrate hydrolyzing enzymes,  $\alpha$ -amylase and  $\alpha$ -glucosidase, in the digestive organs<sup>29,30</sup>. Literature suggests that phenolic phytochemicals are natural inhibitors of  $\alpha$ -amylase and  $\alpha$ -glucosidase with a strong inhibitory effect on  $\alpha$ -glucosidase, but a mild inhibitory effect on  $\alpha$ -amylase and thus can be effective in preventing postprandial hyperglycemia after ingestion of a mixed carbohydrate diet which could be an effective strategy in the control of type 2 diabetes<sup>31-36</sup>.

The aqueous extract of *Emblica officinalis* Gaertn seeds was investigated for its anti-diabetic activity in animal models. Streptozotocin (STZ)-induced type 2 diabetes models were used for the study. This evidence clearly indicates that the aqueous extract of *E. officinalis* seeds has definite hypoglycemic potential as well as anti-diabetic activity<sup>37</sup>.

Phyllanthus species was found to be involved in regeneration and rejuvenation of beta cells, thus leading to an increased insulin production and secretion. This mechanism decreases the blood sugar levels<sup>38</sup>. Evidence indicates that the aqueous extract of *E. officinalis* has definite hypoglycemic potential as well as anti-diabetic activity. The fruits are used in the treatment of diabetes<sup>7,39,40,41</sup> and an infusion of the seeds are also used<sup>42</sup>. Decoctions of the leaves and seeds are also used in the treatment of diabetes mellitus<sup>43</sup>.

Polyphenolic compounds are present in a number of medicinal plants that are reported to possess antidiabetic and antihyperlipidemic activity, thus it is possible that polyphenols abundant in *E. officinalis* fruit juice (541.3 mg gallic acid equivalent/1 g extract) might be responsible for glucose-lowering and the lipid lowering effects of fruit juice, which may be responsible for cardioprotective effects<sup>44</sup>.

Amla decreased low-density lipoprotein cholesterol and increased HDL cholesterol in ovariectomized rats fed chow or fructose. In ovariectomized and fructose-fed rats, it prevented insulin resistance aside from subduing the rise in TG. Amla may be explored for its use in preventing dyslipidemia in post menopausal women<sup>45</sup>.

Amla fruit ash contains chromium, zinc, and copper. Presence of chromium is of therapeutic value in diabetes<sup>36</sup>. Chromium, a trace element possesses significant antidiabetic activity in various experimental models of diabetic mellitus. Chromium compounds also improved deranged lipid metabolism of both type 1 and type 2 diabetic rats. It has been reported that insulin derived with chromium is capable of reversing blood sugar, serum cholesterol and phospholipids levels to those of normal rats<sup>46</sup>.

Different formulations of amla are used for curing different diseases. Flavonoids obtained from amla exert hypoglycaemic and hypolipidaemic effects and elevated haemoglobin levels in rats<sup>47</sup>.

Emblica and tannoids treatment partially prevent the altered activities of antioxidant enzymes. These data clearly demonstrate that Emblica and tannoids not only inhibit osmotic stress but also prevent hyperglycemia-induced oxidative stress probably due to the inhibition of the polyol pathway<sup>48</sup>.

## Conclusion

In conclusion, it can be said that research on plants and their role in disease prevention has gained focus. More research and large clinical trials are needed to prove the beneficial effects of plants. Further, Amla being the richest food source of Ascorbic Acid that is preserved by the presence of galleoellagi tannins, may be used as a supportive therapy for diabetes and other diseases.

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