

Useful medicinal plants in cardiovascular ailments

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Introduction

Coronary artery disease (CAD) popularly known as “Heart attack” is the largest killer of the mankind in the developed countries and is rapidly assuming a similar role in developing world (1). Its extent can be gauged by the fact that annually more than one million coronary angiographic procedures are performed in USA alone (2). It has been predicted that cardiovascular disease will be the most important cause of mortality in India by the year 2015 (3). Recent studies have shown a high prevalence of CAD in both urban and rural populations of India. The incidence of CAD among the Indian urban population has multiplied nine times between 1960s to 1990s. The disturbing trend of steadily increasing incidence of CAD in younger age group (20-39 years) warrants urgent remedial steps. People who suffer from CAD usually have some manifest risk factors. Therefore, it is strategically important to identify the various risk factors which make one prone to get CAD.

The principal risk factors for CAD are smoking, hypertension (HTN), diabetes mellitus (DM), central obesity, dyslipidemia and stress. It is also a fact that none of the presently available conventional medicines like B blockers, calcium channel blockers, angiotensin converting enzyme (ACE) inhibitors, carvedilol, nitrates and aspirin can contain ill effects of these factors single handedly on their own. Aggressive management by the way of coronary artery bypass grafting (CABG), percutaneous transluminal coronary angioplasty (PTCA) management and stent procedures are too costly for a developing country like ours. Moreover, there is no guarantee that the disease will not recur in future after these procedures. Viewed in this context, medicinal plants assume an important role as most of the above mentioned risk factors can be taken care by judicious use of medicinal plant drugs which are abundantly found in Indian subcontinent (4-6). The plant based drugs have been found to be effective in clinical and experimental studies. The mere facts that they have been in use for treating heart ailments since a long time, say 500 BC, itself speaks volume of their utility. Plants which have been found useful in this reference are *Terminalia arjuna*, *Embolia officinalis*, *Withania somnifera* and *Ocimum sanctum*. We shall be discussing habitat, phytochemical, pharmacological and clinical properties of these plants in the present communication.

Terminalia arjuna (Roxb.) Wight & Arn. — It is popularly known as “Arjuna” and is a large (up to 22 m in height) deciduous perennial tree belonging to family *Combretaceae*. It is found in abundance throughout Indo sub-Himalayan tracts of Uttar Pradesh, South Bihar, Madhya Pradesh, Delhi and Deccan region. It is also found in forests of Sri Lanka, Myanmar and Mauritius. Its bark is used as medicine in heart disease since 600 BC. Both Charak and Sushruta mentioned this plant in their treatise. It was Vagbhatta who for the first time advocated use of its stem bark powder in heart ailment.

The main constituents of its stem bark powder include glycosides viz, arjunine, arjunetin, arjunoside I, arjunoside II, triterpeno-glycoside, bioflavonoids and minerals such as calcium, magnesium, zinc and copper (7).

Chaturvedi first reported that alcoholic extract of the bark significantly increases euglobulin lysis time, prolongs prothrombin time and lowers serum cholesterol in CAD patients (8). Subsequently another report about its utility in complete heart block of ischaemic etiology was published. According to this report the particular patient, an adult male who developed Strokes Adams attack following chest pain,

became well after 3 months use of *T. arjuna* crude powder (7).

In another study comprising 30 CAD patients, *T. arjuna* was found to modify various known coronary risk factors like obesity, hypertension, diabetes



Terminalia arjuna

mellitus and circulating catecholamines. No significant side effects were reported in this study (7). Later on Dwivedi and Aggarwal further studied the effect of *T. arjuna* in 15 stable angina cases and found it effective in reducing intensity and frequency of angina pectoris and improvement in effort tolerance. The drug lowered systolic blood pressure and body mass index and increased HDL-cholesterol. Same group of workers reported the beneficial effects of *T. arjuna* in stable angina CAD patients using treadmill exercise test and echocardiographic parameters after 4 weeks of therapy (9, 10).

T. arjuna has Prostaglandin E_2 (PGE_2) like activity following isoproterenol ischaemia in rabbit. PGE_2 is known to induce coronary vasodilatation and hypotension (11). It also inhibits platelet aggregation. It has been found to have negative inotropic and negative chronotropic action in isolated spontaneously beating rat atrium (12).

Intravenous administration of *T. arjuna* extract in experimental patients lead to dose dependent decrease in blood pressure and heart rate. It has also shown antihypertensive and antiarrhythmic activity and delayed the myocardial ischaemia.

In an experimental study, hypercholesterolemic rabbits receiving *T. arjuna* treatment showed more marked reduction in total cholesterol and triglycerides and elevation in HDL cholesterol compared to hypercholesterolemic control rabbits (13). Administration of aqueous extracts of *T. arjuna* produced marked fall in cholesterol levels associated with decreased aortic and tissue atherosclerosis.

Recently Dwivedi and Jauhari (1997) studied the effect of *T. arjuna* on anginal frequency, left ventricular ejection fraction (LVEF) and left ventricular mass (LVM) in CAD patients and found significant reduction in anginal frequency (3.5 ± 1.98 to 1.08 ± 1.08), improvement in LVEF ($42.25 \pm 9.96\%$ to $52.67 \pm 12.32\%$) and reduction in LVM ($159.18 \text{ gm/m}^2 \pm 55.65$ to $140.62 \pm 55.65 \text{ gm/m}^2$) following 3 months of adjuvant *T. arjuna* therapy (10).

The antianginal activity of *T. arjuna* coupled with enhancement of PGE_2 like activity, negative chronotropic, antiarrhythmic, antihypertensive, hypolipidemic, HDL cholesterol raising properties and its potential to improve LVEF and reduce LVM makes it eminently cardioprotective drug in over all management of CAD. Recently, a new glycoside, $2\alpha,19\alpha$ -dihydroxy-3-oxo-olean-12-en-28-oic acid 28-O- β -D-glucopyranoside isolated from roots of this plant has shown antifungal activity against *Aspergillus niger* and *Candida albicans*.

Toxicity and side effects

In various clinical studies, *T. arjuna* was used in the dose of 1-2 g per day which has been found to be the optimum dose in patients of CAD. At this dosage it is well tolerated (14). However, some patients complain of mild gastritis, headache and constipation. No metabolic, renal and hepatic toxicity has been reported even when patients were administered *T. arjuna* for more than 24 months (15).

Emblica officinalis



Table 1 : Cardiovascular friendly plants

Name	Family	Vernacular Name (Hindi)	Parts Used	Medicinal Properties
<i>T. arjuna</i>	Combretaceae	Arjuna	Bark	Diuretic, antianginal, improves Congestive heart failure (CHF) and LVEF, reduces IVM, antioxidant, prolongs prothrombin time and euglobulin lysis time, enhances PGE ₂ like activity, inhibits platelet adhesion and aggregation, antihypertensive, hypocholesterolemic and HDL cholesterol raising effect
<i>E. officinalis</i>	Euphorbiaceae	Aonla	Dried fruit, seeds, leaves	Diuretic, antioxidant and hypolipidemic
<i>O. sanctum</i>	Lamiaceae	Tulsi	Leaves, seeds	Hypotensive and cardiac depressant activity, hypoglycemic, antistress, hypolipidemic, potentiates action of exogenous insulin
<i>W. somnifera</i>	Solanaceae	Ashwagandha	Dried roots	Diuretic, narcotic, antistress and adaptogen, antioxidant

Emblica officinalis Gaertn. — It is commonly known as “Aonla” belonging to family *Euphorbiaceae*. It is small or middle-sized deciduous tree. Leaves feathery with small narrowly oblong, pinnately arranged leaflets. Fruits small 1.5-2.5 cm in diameter, fleshy, roundish, obscurely 6-lobed, pale green or yellowish containing single, 6-trigonus seeds.

The plant occurs throughout tropical and subtropical India; it is found abundantly in deciduous forests of Madhya Pradesh. Though all of its parts including dried fruit, seeds, leaves, root, bark and flowers are used for medicinal purposes. Mostly its dried fruit have been used for therapeutic purposes (16, 17, 18). The fruits are one of the three constituents of the well known Indian preparation

Triphala which is used as laxative and in treatment of enlarged liver, piles and stomach complaints.

E. officinalis is very rich in vitamin C. Vitamin C has been claimed to possess antioxidant and hypolipidemic property. It has been found to reduce serum total cholesterol, aortic cholesterol levels in both normal and cholesterol induced hypercholesterolemic rabbits (19).

The effect of *E. officinalis* on total serum cholesterol and its lipoprotein fraction has also been studied in normal and hypercholesterolemic men aged 35-55 years. The supplement was given for a period of 28 days in the raw form. Both the normal and hypercholesterolemic subjects showed a decrease in cholesterol

levels. Two weeks after withdrawing the supplement, the total serum cholesterol levels rose significantly almost to initial levels (20).

A fermented liquid made from fruits is considered useful in indigestion, anaemia, jaundice and common cold. Dried fruits are useful in diarrhoea and dysentery.

Ocimum sanctum Linn. — It is commonly known as *tulsi* or *tulsee*, Sacred Basil belonging to family *Lamiaceae*. This is well known sacred plant of the Indians. It is a much-branched erect herb, up to 75 cm in height, hairy all over. Its leaves, seeds and roots are used for medicinal purposes. It is found throughout India

up to an altitude of 1,800 meters in the Himalayas. It is also cultivated in temples and gardens.

Gas liquid chromatography of the essential oil of *O. sanctum* yields



Ocimum sanctum

eugenol as major constituent, besides methyleugenol, caryophylline, calcium, phosphorous and insoluble oxalate.

Crude watery extract of *O. sanctum* leaves showed transient hypotensive effect in anaesthetized dogs and cats. It exerts negative inotropic and chronotropic effect on rabbit heart (21).

O. sanctum is said to possess hypotensive and antistress activity. In study done by Chattopadhyay (1993) *tulsi* leaves have been demonstrated to possess potent hypoglycaemic activity in normal and streptozotocin diabetic rats (22, 23).

Withania somnifera Dunal —It is popularly known as "Ashwagandha" belonging to family *Solanaceae*. This is a small or medium sized under shrub up to 1.5 meters high. Stem and branches are covered with minute star - shaped hairs. The plant occurs in drier region of India. It is also cultivated. The dried roots of the plant are used for medicinal purposes. It is useful in consumption, generalized weakness and rheumatism. Root possesses diuretic and narcotic properties. It acts as an antistress and adaptogen (24). Ahumada *et al.* (1991) demonstrated its hypotensive and cardiogenic properties. The roots as well as leaves have recently been reported to

possess antibacterial activity (25). Its effect on behavioural, physiological, immunological and biochemical perturbations are qualitatively similar to those exhibited by *Panax ginseng* Mey. It has also been found to possess antioxidant properties (26, 27).

The combination of the above mentioned four drugs (*T.arjuna*, *Emblca officinalis*, *Ocimum sanctum* and *Withania somnifera*) has been effective in reducing the clinical manifestations of stable angina pectoris. Its use resulted in 75% reduction in use of sublingual isosorbide dinitrate (IDN).

Conclusion

In overall assessment it appears that plant based drugs comprising *T.arujna*, *Emblca officinalis*, *Ocimum sanctum* and *Withania somnifera* (Table-1) needs to be used much more by medical fraternity for treating coronary artery disease patients. These drugs are cost effective and temperamentally quite suiting to millions of our masses.

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Withania somnifera

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