Review Article

CARDIOPROTECTIVE ACTIVITY OF MEDICINAL PLANTS: A REVIEW

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ABSTRACT

Cardiotoxicity is a condition that occurs during therapy with several cytotoxic drugs and may be the dose limiting factor in the cancer therapy or imbalanced diet and lifestyle. The use of herbal supplements has become increasingly popular in recent years. Among all the cardio vascular diseases, Myocardial infarction is considered as one of the most dangerous disease. The treatment available may not be sufficient to treat the disease as it is caused by many factors to overcome the adverse effects caused by the synthetic medicine available. There is a need for the natural therapy with the help of medicinal plants.

Keywords: Cardioprotective, Doxorubicin, Myocardial Infarction.

INTRODUCTION

The cardiovascular system consists of heart & blood vessels which circulate blood throughout the body. It is responsible for transporting oxygen, nutrients, and hormones to body and removes cellular waste products from the body.

Introduction to cardio vascular diseases [CVD]: The term cardiovascular disease [CVD] is very much familiar which commonly refers to a group of diseases that affects heart and its parts, whereas the term CVD mostly refers to MI [Myocardial infarction], angina pectoris, hypertension, stroke and other circulatory diseases. The common heart diseases that have been reported are coronary artery diseases, congestive heart failure, cardiac arrest, arrhythmias, and peripheral artery diseases.

The key facts of CVD

It was known that number 1 cause of death globally is due to cardiovascular diseases because annually more people die from heart diseases than from any other grounds.

- Approximately 17.5 million people died from CVDs in the year 2012, representing 31% of all global deaths. Of these deaths, 7.4 million were due to coronary heart diseases and 6.7 million deaths were due to heart stroke.
- Out of the 16 million deaths under the age of 60 due to non-communicable diseases, 85% are in low and middle income countries and 40% are caused by CVDs¹.

Types of cardio vascular diseases [CVD]

There are different types of cardio vascular diseases among them based on the prevalence of diseases across the world the most considerable CVD are like Atherosclerosis, Myocardial infarction, Ischemia, Cardiomyopathy^{2,3}.

TREATMENT

Various medications used to treat a heart attack:

- Blood thinners, Thrombolytics, Nitroglycerin
- Antiplatelet drugs, such as clopidogrel
- Beta-blockers, ACE inhibitors
- Pain reliever⁴.

LIST OF MEDICINAL PLANTS USED TO TREAT MI

Ananas comosus [Family: Bromeliaceae]

Priya Saxena *et al.*, evaluated the cardioprotective effect of hydro alcoholic extract of *Ananas comosus* [HEAC] on Isoproterenol [ISO] [85mg/kg, s.c] induced myocardial infarction in Albino Wistar rats. Bromelian-proteolytic enzyme, citric acid, malic acid, vitamins- A, B, C are responsible for the cardioprotective role⁵.

Arachis hypogaea [Family: Fabaceae]

Karthik *et al.*, evaluated and reported the presence of resveratrol in *Arachis hypogaea* which has a potent cardioprotective role. The high content of resveratrol is responsible for reversing the tissue injury⁶.

Carissa opaca [Family: Apocynaceae]

Sumaira Sahreen *et al.*, evaluated the cardioprotective role of leaves extract of *Carissa opaca* against ccl₄ induced toxicity in Sprague dawley rats. Flavonoids [rutin], vitexin, isoquercetin, myricetin, kaempferol are the main phytoconstituents which shows potent cardioprotective activity⁷.

Cassia tora [Family: Caesalpiniaceae]

Nagarathna *et al.*, *Cassia tora* is an herbal medicinal plant and it is used to cure different disorders. Chrysophanol, emodin, rubrofuscarin, flavonoids, anthraquinone glycosides are the active principles which are responsible for cardioprotective effect⁸.

***Cinnamomum tamala* [Family: Lauraceae]**

Nagaraju *et al.*, evaluated the cardio protective potential of Ethanolic Extract of dried leaves of *Cinnamomum tamala* [EECT], against doxorubicin induced myocardial infarction in Wistar albino rats. EECT elicited a significant cardio protective activity due to presence of Cinnamaldehyde, eugenol, phellandrene, monoterpenes [trans-sabinenehydrate], sesquiterpenes⁹.

***Coriandrum sativum* [Family: Apiaceae]**

F. Kousar *et al.*, investigated the cardioprotective potential of leaves of *coriandrum sativum* against salbutamol induced cardiac injury in rabbits. The potent cardioprotective activity was due to Alkaloids, glycosides, flavonoids, triterpenoids, volatile oils and phenolic compounds¹⁰.

***Cornelian cherry* [Family: Cornaceae]**

Masoud Eshaghi *et al.*, evaluated the cardioprotective activity of *Cornus mas* fruit extract [CMFE], and reported the presence of high antioxidant content in *Cornus mas* fruit extract [CMFE] which is responsible for peroxidation of membrane lipids, recover the enzymatic antioxidant defence system and act as curative agents for cardiotoxicity¹¹.

***Croton sparciflorus* [Family: Euphorbiaceae]**

Abi Beaulah G *et al.*, reported the the presence of active phytoconstituents like flavonoids, glycosides, alkaloids in the methanolic extract of *Croton sparciflorus* which is responsible for the cardio protective activity¹².

***Curcuma longa* [Family: Zingiberaceae]**

Eman M. El-Sayed *et al.*, evaluated the cardioprotective effects of ethanolic and aqueous extracts of *curcuma longa* against doxorubicin induced cardiotoxicity in sprague-dawley rats. Secondary metabolites like Curcuminoids, terpinolone, p-cymene, undecanole, 1, 8-cineole, α -turmerone, β - turmerone possess potent cardioprotective activity¹³.

***Cyperus rotundus* [Family: Cyperaceae]**

Nazishjahan *et al.*, evaluated the cardioprotective effect of methanolic extract of *Cyperus rotundus* against isoproterenol induced cardiotoxicity. 200mg/kg of *cyperus rotundus* extract has potent cardio protective activity which is closely related to normal group¹⁴.

***Ficus racemosa* [Family: Moraceae]**

Ahmed F *et al.*, evaluated the cardioprotective activity of acetone extract of *Ficus racemosa* stem bark against doxorubicin induced cardiotoxicity in rats. 500mg/kg dose of plant extract shows the potent cardioprotective effect closely resembling standard cardiotonic¹⁵.

***Garcinia indica* [Family: Cluciaceae]**

Karunakar hegde *et al.*, reported the presence of Garcinol-major phytoconstituent, xanthones, flavones, benzenes, polyphenolic compounds are responsible for potent cardioprotective activity of aqueous extract of *Garcinia indica* Linn fruit rinds¹⁶.

***Hibiscus sabdariffa* [Family: Malvaceae]**

Abba Pacome Obouayeba *et al.*, evaluated the cardioprotective activity of polyphenols enriched aqueous extract of petals of *Hibiscus sabdariffa* on wistar rats. 200mg/kg of aqueous extract of *hibiscus sabdariffa* containing flavonoids [gossypetin, Hibiscetin, quercetin, sabdaretin], anthocyanins, catechin and ellagic acid shows potent cardioprotective activity¹⁷.

***Justicia traquebariensis* [Family: Acanthaceae]**

Radhika.J *et al.*, Cardioprotective Role of Leaf Extract of *Justicia traquebariensis* in Isoproterenol Induced Myocardial Infarction in Albino Rats. Umbelliferone, flavonoids, coumarins, Triterpenoids, glycosides are responsible for its cardioprotective role¹⁸.

***Lagenaria siceraria* [Family: Cucurbitaceae]**

Upanganlawar *et al.*, reported the presence of Flavone-C Glycosides, Vitamins-A, D, B12; Triterpenoid cucurbitacins B, D, G, H and 22-deoxy cucurbitacin. Sterols [fucosterol, campesterol], aerpenebyonolic acid [an allergic compound], Lageninin. The *Lagenaria siceraria* fruit juice which is responsible for potent cardioprotective activity¹⁹.

***Lavandula angustifolia* [Family: Lamiaceae]**

Mojtaba Ziaee *et al.*, *Lavandula angustifolia* is a herbaceous plant with antioxidant properties. Essential oil of lavandula maintained the structure and architecture of cardiac cells by decreasing cardiac tissue damage and strengthening myocardial membrane because of presence of camphor, limonene, tannins, triterpenoids, coumarins, cineole and flavonoids. If the beneficial effects of *L.angustifolia* essential oil could be reproduced in human beings; our findings may introduce a novel therapy for prevention and treatment of myocardial infarction²⁰.

***Lepidium sativum* [Family: Brassicaceae]**

Eman Taha Mohamed *et al.*, cardio toxicity is a major complication of 5-flouro uracil which is used in the treatment of solid tumors. A suspension of *Lepidium* seed powder has potent cardioprotective activity due to the presence of cardiac glycosides, flavonoids, polyketides, vitamins, minerals²¹.

***Mangifera indica* [Family: Anacardiaceae]**

S.Prabhu *et al.*, From the studies carried out it was found that *Mangifera indica* has potent cardioprotective effect which was evidenced with the help of in vivo studies carried on isoproterenol induced cardio toxicity. Presence of Mangiferin-Xanthhone C glycoside, urushiols, kaempferol, quercetin, tannins, flavonoids, polyphenolic compounds in the *Mangifera indica* has potent cardioprotective effect²².

***Medicago sativa* [Family: Fabaceae]**

Gomathi r *et al.*, reported the rich source of vitamins-A, D, E, K, carotenoids, coumarins and its derivatives, sterols, Saponins, flavones and Isoflavones in ethanolic extract of medicago sativa stem. The cardioprotective role may be due to its phytochemicals and antioxidant content²³.

***Momordica charantia* [Family: Cucurbitaceae]**

Adedeji Gabriel Temito pe *et al.*, reported the cardioprotective activity of *momordica charantia*, frequently used as antidiabetic herbin Ayurvedic system of medicine. *Momordica charantia* shows the dose dependent cardioprotective activity due to presence of triterpenoids, Momordenol, momordicilin, momordicinin, charantidiol, Saponins, cucurbitins²⁴.

***Moringa oleifera* [Family: Moringaceae]**

Oseni *et al.*, reported the presence of alkaloids, phenols, flavonoids, sugars and saponins in the leaves of *Moringa oleifera* which is responsible for the cardioprotective effect of aqueous extract of *Moringa oleifera* leaf²⁵.

***Nelumbo nucifera* [Family: Nymphaeaceae]**

Kirithika.T *et al.*, *Nelumbo nucifera*, a well known plant in ancient medicinal sciences which is also used to treat obesity and summer heat syndrome in china and japan. The methanolic extract of nelumbo nucifera flower containing Nuciferine,

alkaloids, glycosides, myricetin, quercetin, flavonoids [kaempferol], nonflavonoids [adenine, sitosterols] shows the cardioprotective effect which is closely related to the standard drug metocord²⁶.

***Newbouldia laevis* [Family: Bignoniaceae]**

K. N. Agbafor *et al.*, reported the cardioprotective potential of aqueous extract of leaf and root in ccl₄ induced cardiotoxicity in Albino wistar rats. The extracts contained alkaloids, tannins, saponins, flavonoids, anthraquinones, terpenoids and cardiac glycosides in varied proportions which contribute to the various medicinal applications of leaves and roots of *Newbouldia laevis*²⁷.

***Nigella sativa* [Family: Ranunculaceae]**

Hammad Shafiq *et al.*, *Nigella sativa* oil and seeds have been widely used to management of different diseases within centuries and regarded as important drug in traditional medical system in Asian and Middle East countries [Ayurveda, Unani, Arabic and Chinese medicines]. Studies have reported that *Nigella sativa* containing Thymoquinone, Saponins, flavonoids, anthocyanins, alkaloids has favourable effects on the lipid profile and it significantly reduces serum cholesterol LDL and triglycerides levels *Nigella sativa* prevents non enzymatic lipid peroxidation by its potent antioxidant activity²⁸.

***Ocimum basilicum* L. [basil] [Family: Labiatae]**

Fathiazad *et al.*, The leaves of the plant *Ocimum basilicum* L. [basil] was known and suggested to be cardioprotective due to rosmarinic acid content. The extracted constituents have shown the potent activity in Wistar rats that were induced with isoproterenol myocardial infarction. Rosmarinic acid was the principle phenolic compound with a 15.74% which shows cardioprotective effects could be related to antioxidative activities²⁹.

***Parkia biglobosa* [Family: Fabaceae- Mimosoideae]**

Komolafe K *et al.*, investigated and reported the Aqueous-methanolic leaf extract of *Parkia biglobosa* [PBE] contains saponins, tannins, cardiac glycosides, total flavonoid [121.30±3.2 mg Quercetin equivalent], phenolic compounds [gallic acid, ellagic acid] which is used as antioxidative and antihyperlipidemics³⁰.

***Pithecellobium dulce* [Family: Fabaceae]**

Bhavani *et al.*, The valuable effects of utilization of *Pithecellobium dulce* flower and fruit on cardio protective activity have been reported. In the study of cardio protective activity valued flower and fruits aqueous extracts of *Pithecellobium dulce* plant on isoproterenol induced myocardial infarction in rats, in that the appearance of normal cells denoted the plant extract vigorously involved for the treatment of heart disease³¹.

***Raphanus sativus* Linn. [Family: Cruciferae]**

Manish Shah *et al.*, *Raphanus sativus* was estimated for the cardioprotective activity that is against myocardial injury induced by isoproterenol [ISO] on the basis of its effect on biochemical and histological parameters. Presence of Anthocyanins, glucosinolates, isothiocyanates, phenolics, fatty acids are responsible for cardioprotective effect³².

***Rubia cordifolia* [Family: Rubiaceae]**

Pankaj Bhatt *et al.*, reported that *Rubia cordifolia* continually attracting investigators for research work globally. Rubiae Radix [dried roots of *Rubia cordifolia*] is a rich source of anthraquinones responsible for pharmacological activities³³.

***Stachys schimperi* Vatke [Family: Labiatae]**

Essam Abdel-Sattar *et al.*, reported that the *Stachys schimperi* Vatke [Family Lamiaceae] has cardioprotective effect on DOX-induced cardiotoxicity in rats based on biochemical and histopathological parameters. The phenolic profile of the methanol extract was determined qualitatively by HPLC. Isoscutellarein 7-O-[200-O-[60 0 0-acetyl]-b-D-allopyranosyl]-b-D-glucopyranoside [compound 1] was isolated and identified from EthanoButanolic [EB] fraction as a major constituent for the first time from this *Stachys* species. The methanolic extract and the combined EtOAc and n-butanol fractions [EB] as well as compound 1 showed prominent free radical scavenging activity when assessed by the DPPH method. Additionally, histopathological studies denoted the mild protection against DOX-induced cardiotoxicity³⁴.

***Syzygium aromaticum* [Family: Myritaceae]**

Jay Rabadia *et al.*, Myocardial infarction was induced by a subcutaneous administration of isoproterenol. Extract of *Syzygium Aromaticum* was administered at a dose of 250, 500 and 750 mg/kg for 30 days. *Syzygium Aromaticum* contain eugenol, eugenol acetate, caryophyllene, sesquiterpene ester are having antioxidant, anti-lipid peroxidative, free radical scavenging properties and anti-ischemic activity justify its potential therapeutic value in the treatment of ischemic heart diseases in albino rats³⁵.

***Tamarindus indica* Linn [Family: Caesalpiniaceae]**

Nabeel kinattingal *et al.*, carried a study to evaluate the cardioprotective activity of *Tamarindus Indica* Linn in Isoproterenol hydrochloride induced Myocardial Infarction in rats. Among various solvent extracts of seed and fruit tested, alcoholic seed extract contains Alkaloids, sesquiterpenes, Saponins, tannins, phlobatamins which have shown potent cardioprotective effect³⁶.

***Terminalia arjuna* [Family: Combretaceae]**

Sivakumar *et al.*, *Terminalia arjuna* Linn. is used in Indian Ayurvedic medicine for the treatment of various diseases. It has been reported for the cardio protective effect with different parts like bark and seed containing a wide range of phytoconstituents like triterpenoids [arjunic acid, arjunolic acid], tannins, flavonoids like luteolin, Arjunone, Arjunolone; gallic acid, ellagic acid, arjun glycosides and phytosterols³⁷.

***Tinospora cordifolia* [Family: Menispermaceae]**

Neha Kesarwani *et al.*, conducted a study to evaluate the cardioprotective effect of *Tinospora cordifolia* on isoprenaline induced myocardial infarction. It shows potent cardioprotective role due to Alkaloids [tinospurin], cardiacylglycosides [tinocordiside, tinocordifolioside], diterpenoids, sesquiterpenoids, steroids, phenolics³⁸.

***Trichopus zeylanicus* [Family: Trichopodaceae]**

Sivanandham Velavan *et al.*, evaluated the cardioprotective effect of *Trichopus zeylanicus* leaves against isoproterenol induced myocardial ischemia. The potent cardioprotective activity of *T.zeylanicus* due to glycosides, alkaloids, flavonoids, terpenoids, Saponins, phytosterols³⁹.

***Vitis labrusca* var. Bordo [Family: Vitaceae]**

Livia s. oliboni *et al.*, evaluated and reported the presence of Cardiac glycosides, sterols, phenolics, volatile oils of organic and conventional grapevine [*Vitis labrusca*L.] leaf extracts in reducing hydrogen peroxide-induced stress in the liver, heart and kidney of Wistar rats by measuring lipids and proteins damages [carbonyl assay], as well as the activity of the antioxidant enzymes superoxide dismutase and catalase. The

beneficial effects of the *V. labrusca* leaf extract shown in this study could probably be important for formulating dietary supplements, as well as for developing new ingredients with improved antioxidant properties from other plant sources⁴⁰.

The images of above mentioned medicinal plants are given below (Figure 1-6)

Figure 1

Figure 2

Figure 3

Figure 4

Figure 5

Figure 6

CONCLUSION

The present review reveals the importance of medicinal plants in preventing and reversing the cardiovascular diseases and makes an attempt to compile some of the cardio protective plants. Medicinal plants and their supplements can help in lowering the risk of cardiovascular diseases. Secondary metabolites such as carotenoids, cardiac glycosides, alkaloids, flavonoids, polyphenolic compounds, saponins, terpenoids [triterpenes], fatty acids which are present in medicinal plants were considered as the responsible agents for potent cardio-protective activity.

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