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 cardiovascular 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 CVDs.

Types of cardiovascular diseases [CVD]

There are different types of cardiovascular diseases among them based on the prevalence of diseases across the world the most considerable CVD are like Atherosclerosis, Myocardial infarction, Ischemia, Cardiomyopathy.

TREATMENT

Various medications used to treat a heart attack:
- Blood thinners, Thrombolytics, Nitroglycerin
- Antiplatelet drugs, such as clopidogrel
- Beta-blockers, ACE inhibitors
- Pain reliever

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 role.

Arachis hypogea [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 injury.

Carissa opaca [Family: Apocynaceae]
Sumaira Sahreen et al., evaluated the cardioprotective role of leaves extract of Carissa opaca against ccl-induced toxicity in Sprague dawley rats. Flavonoids [rutin], vitexin, isoqueretin, myricetin, kaempherol are the main phytoconstituents which shows potent cardioprotective activity.

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 effect.
Cinnamomum tamala [Family: Lauraceae]
Nagaraju et al., evaluated the cardio protective potential of
Ethanol 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],
sesquiterpenes.9

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
Corusus mas fruit extract [CMFE], and reported the presence of
high antioxidant content in Corusus 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, a-turmerone,
ß-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 cardiotoxic15.

Garcinia indica [Family: Clusiaceae]
Karunakar hegde et al., reported the presence of Garcinol-major
phytoconstituent, xanthones, flavonones, benzenes, polyphenolic
compounds are responsible for potent cardioprotective activity
of aqueous extract of Garcinia indica Linn fruit rinds.16.

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, sabdarinetin], anthocyanines, catechin and
ellagic acid shows potent cardioprotective activity17.

Justicia traquebariensis [Family: Acanthaceae]
RadhikaJ 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 cucubitacins B, D,
C, H and 22-deoxy cucubitacin. Sterols [fucosterol,
campesterol], aerepinebonylic acid [an allergic compound],
Lageninin. The Lagenaria siceraria fruit juice which is
responsible for potent cardioprotective activity19.

Lavandula angustifolia [Family: Lamiaceae]
Mojtaba Taha Mohamed 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 Lavangustifolia 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 cardiac toxicity. Presence of Mangiferin-
Xanhphone C glycoside, ursshiol, 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 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, Morodendrin, momordicilin,
momordicin, 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 Nuicerine,
alkaloids, glycosides, myricetin, quercetin, flavonoids [kaempferol], nonflavonoids [adénine, sitosterols] shows the cardioprotective effect which is closely related to the standard drug metocord26.

**Newbouldia laevis [Family: Bigoniaceae]**

K. N. Aghafoor et al., reported the cardioprotective potential of aqueous extract of leaf and root in cdI 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 have 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 rosmaniric 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±9.3 mg Quercetin equivalent], phenolic compounds [gallic acid, ellagic acid] which is used as antioxidative and antiyperlipidemics30.

**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. Ioscutellarenin 7-O-[200-O-60.0 (acetyl)-b-D-allyloporanosyl]-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: Myrtaceae]**

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: Caesalpiniaeae]**

Nabeel kinattingal et al., carried a study to evaluate the cardioprotective activity of *Tamarindus Indica* Linn in Isoproterenol hydrogenchloride 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, arjunic 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 [tinosporin], cardiacglycosides [tincordiside, tincordifolioside], 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]**

Liviu S. Olboni et al., evaluated and reported the presence of *Cardiac glycosides, sterols, phenolics, volatile oils of organic and conventional grapevine [Vitis labruscal.]* 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 sources. The images of above mentioned medicinal plants are given below (Figure 1-6)

**Figure 1**

![Medicago sativa](image1) ![Nelumbo nucifera](image2)

![Momordica charantia](image3) ![Newbouldia laevis](image4)

![Moringa oleifera](image5) ![Nigella sativa](image6)

**Figure 2**

![Hibiscus sabdariffa](image7) ![Lavandula angustifolia](image8)

![Justicia traqueberiensis](image9) ![Lepidium sativum](image10)

![Lagenaria siceraria](image11) ![Mangifera indica](image12)
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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