

A REVIEW ON CARDIOPROTECTIVE AND ITS BIOACTIVE COMPOUNDS

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Abstract -- Cardiovascular diseases are the most widespread and topmost lives and death claim global disease. Studies show that this chronic illness not only influence on people above 60's and it also has an adverse affect of people from the age of 20 and above. A person on drug treatment have to try different modern drugs which is effective and has few side effects and toxicity. Modern drugs utilizes plant extracts which have effective bioactive compounds, are identified from an ancient traditional medicinal plants presents an leading opportunity for the synthesis of new drug development. Secondary metabolites like carotenoids, triterpenes, flavonoids, cardiac glycosides, alkaloids, saponins, polyphenols, terpenoids, fatty acids etc were responsible for cardioprotective activity at a particular dose which was evaluated using appropriate pharmacological screening approach. Many plants such as *Allium sativum*, *Allium cepa*, *Asparagus racemosus*, *Caesalpinia bonducella*, *Cassia fistula*, *Curcuma longa*, *Emblia officinalis*, *Garcinia indica*, *Hemidesmus indicus*, *Ocimum sanctum*, *Phyllanthus amarus*, *Terminalia arjuna*, *Trigonella foenum-graecum*, *Vitis vinifera* are some of the plants that exhibit cardio protective activity¹. This present review paper scopes for further research activities in screening medicinal plants for cardioprotective phytoconstituents and assessing their potential in protecting against cardiovascular diseases.

Index Terms -- Medicinal plants, cardiovascular, health benefits, phytoconstituents, Anthocyanins, carotenoids, biochemical estimations.

INTRODUCTION

Several food products and environmental conditions play a key role in the development of various human diseases, among them cardiovascular disease is one of the most fatal disease and there are more than 60 types of cardiovascular disease which leads to a group of disorders includes high blood pressure,

congestive heart failure, coronary heart disease, congenital heart disease, heart inflammation, ischemic heart disease and stroke.

According to WHO, the estimated people were affected due to the cardiovascular disease around 17.5 millions. In India, there are 30 million heart patients and still there is no effects to minimize the risk. With the advent of modern drug treatments, the scope of cardiovascular drugs have been increased enormously and new drugs are being approved. There are a wide variety of modern drugs like aspirin, antiplatelet drugs, anti-arrhythmic drugs, Angiotension-converting Enzyme Inhibitor, Angiotension II receptor blocker² etc. A person on drug treatment have to try different modern drugs which is effective and has few side

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effects and toxicity, to find the right treatment. Across cultures, there are many different dietary patterns which are believed to suppress the cardiovascular diseases. Along with this, phytochemical constituents have effective bioactive compounds which are found and identified from an ancient traditional medicinal plants presents an leading opportunity for the synthesis of new drug development. The best part of medicinal plants doesn't have any side effects and inexpensive³. For example, Perceiving plant foods as beneficial diet is advised by the folklore of many cultures over centuries. For example, *Allium sativum*, *Allium cepa*, *Asparagus racemosus*,

Caesalpinia bonducella, *Cassia fistula*, *Curcuma longa*, *Emblica officinalis*, *Garcinia indica*, *Hemidesmus indicus*, *Ocimum sanctum*, *Phyllanthus amarus*, *Terminalia arjuna*, *Trigonella foenum-graecum*, *Vitis vinifera* are some of the plants that exhibit cardio protective activity.

In this article, we will focus on the few common cardioprotective phytoconstituents, groups, their distribution and the health benefits present in plants have been discussed in table 1 and some list of cardioprotective plants and their consequences in (table2).

Table 1: List of some common phytoconstituents for cardioprotective activity

S.No.	Phytoconstituents	Other names	Groups	Common Distribution	Health benefits in treating
1.	Anthocyanins (occur as glycosides of anthocyanidins)	-	Flavanoids, Polyphenolic	Black current, blue berry, bilberry, cherry, red grape, purple corn and also in various plants	Cardiovascular health
2.	Anthocyanins : Cyanidin	Flavon-3ol	Flavanoids, Polyphenolic	bilberry, blackberry, blueberry, cherry, cranberry, elderberry, hawthorn, loganberry, raspberry and also in other fruits including apples, pears, peaches and plums.	Heart health problems such as stroke, heart attack, atherosclerosis and ischemia.
3.	Carotenoid : Beta-carotene	Pro-vitamin A	Terpenoids	Mango, apricot, sweet potatoes, carrots, broccoli, spinach, turnip greens	Increase heart health by decreasing blood pressure and atherosclerosis
4.	Carotenoid : Lutein	-		Red peppers, mustard, broccoli, corn, garden peas, spinach and many plants and vegetables.	Reduce artery diseases
5.	Flavanoid	-	Polyphenolic	Fruits, tea, soy bean, green and black tea	Heart diseases.

				and in most plant materials	
6.	Epicatechin	Epicatechol, epicatechin	Flavanoids	Cocoa, tea grapes and many plants.	Improves heart health
7.	Hesperidin	Hesperitin-7-rutinoside	Flavanois	Found in White parts of citrus fruits and pulp such as lemon & oranges and also in green vegetables.	Vasoprotective
8.	Isorhamnetin	3,5,7-Trihydroxy-2-(4-hydroxy-3-methoxyphenyl)-4H-1-benzopyran-4-one	Flavanoids (also a metabolite of quercetin)	Red turnip, mustard leaf	Imrove heart health
9.	Myricetin	Cannabiscetin, Myricetol, Myricitin	Flavanoids	Walnuts, onion, herbs, berries and red grapes	Imrove heart health
10	Proanthocyanidins	Pycnogenol, OPC, OligomericProcyanidins	Flavanoids	Skin and seeds of grapes, cocoa, apple, peanut, almond, blueberries and bark of maritimepine.	Prevent cardiovascular disease by preventing low blood cholesterol.
11.	Quercetin	-	Flavanoids	Common foods including apple, onion, tea, nuts, berries, cauliflower and cabbage.	Lowers blood pressure & reduce the risk of heart disease.
12.	Genistein	-	Isoflavanoids	Main source in soy beans and chick peas	Reduce the risk of atherosclerosis and prevent heart attacks and stroke.
13.	Allicin	Diallylthiosulphinate	Organosulphides	Garlic	Improve heart health.
14.	Indole-3-carbinol	3-hydroxymethyl indole, 3-indole methanol	Indole	Cauliflower, cabbage, broccoli and also after the maceration of vegetables.	Improve heart health.
15.	Sulforaphane	(R)-1-isothiocyano-4-methyl-sulfonyl butane	Isothiocyanates	Cauliflower, cabbage, broccoli	Helps to fight high blood pressure and reduces cholesterol which prevent heart disease.
16.	Digoxin	Digitex, Lanoxin	Cardiac glycoside	Leaves of digitalis plants	Treat congestive heart failure, regulate heart beat.
17.	Saponins	-	-	Vegetables, beans	Reduces the

				and herbs.	risk of heart disease.
18.	Pterostilbenes	3,5-Dimethoxy-4-stilbenol	Stylbenes	Blueberries, grapes and peanuts.	Improve heart health by lowering cholesterol.
19.	Resveratrol	Trans-3,5,4'-trihydroxystilbene	Flavanoids	Plants and fruits including grapes, eucalyptus, blue berries, peanuts	Protects our heart and reduce the risk of atherosclerosis
20.	Astaxanthin	3,3'-Dihydroxy-b,b-carotene-4,4'-dione	Carotenoid	microscopic small plants: the micro-algae Haematococcuspluvius	Improve heart health by reducing inflammation.

Table 2:List of some Cardioprotective plants and its functions ⁴⁻⁴³

S.No.	Plant name/common name	Extract	Studies	Results
1.	punicagranatum L (Pomegranate)	Water (Whole fruit)	Doxorubicin - induced toxicity in rat	Whole fruit Showed protection against myocardial toxicity induced by doxorubicin.
2.	Allium sativum (Garlic)	Garlic juice	Isolated Rat Heart in Ischemia-Reperfusion	The vasoregulatory effects and antioxidant activity of allicin from garlic juice protects myocardial function of the ischemia reperfusion.
3.	curcuma longata L. (turmeric)	Turmeric extracts	Doxorubicin induced cardiotoxicity in rats	Turmeric along with doxorubicin protects against cardiomyopathy.
4.	Hybanthusenaeaspermus (spade flower)	Plant extract	Isoproterenol Induced Rat	Plant extract has ability to treat the cardio toxic effects on Myocardial infarction induced by Isoproterenol
5.	Nelumbonucifera (Lotus)	Leaf extract	Isoproterenol-induced myocardial infarction in rats	The levels of marker enzymes in serum and increasing in heart level showed that leaf extract protects against isoproterenol-induced myocardial infarction
6.	BombaxceibaL. (Silk cotton tree)	Aqueous flower extract	Acute adriamycin-Induced Myocardial infarction in rats	Flower extract showed cardioprotective effect against Adriamycin induced myocardial infarction and it might be due to its antioxidant effect.
7.	Solanumnigrum Linn (Black night shade)	Methanolic extract	Cardioprotective action in ischemic disease in rats	This study showed a change in the level of Thiobarbituric acid reactive substances and antioxidants protection of heart from Ischemic heart disease.
8.	Calotropisgigantea (Madar)	Methanolic root	isoprenaline	The root extract showed

		extract	induced myocardial infarction in rats	cardioprotection against isoprenaline by inhibiting the formation of free radicals generated during oxidation and it also showed pretreatment of cardioprotection through multiple mechanism.
9.	Sidarhombifolia Linn (Arrow leaf sida)	Ethanollic extract	Isoproterenol-Induced Myocardial Infarction in Albino Rats	This study caused myocardial adaptation by augmenting endogenous antioxidants and protects hearts administered against isoproterenol induced myocardial infarction.
10.	Evolvulusalsinoides. Linn (Dwarf morning glory)	Methanolic extract	Isoproterenol - Induced Myocardial Infarction in Albino Rats	This study also shows myocardial adaptation by augmenting endogenous antioxidants and protects hearts
11.	Cyathulaprostrata Linn. (Pasture weed)	Ethanollic extract	Isoproterenol Induced Myocardial Infarction in Rat.	The result showed the antioxidant, antilipidperoxidative and anti-ischemic activity of extract and justifies its potential therapeutic value.
12.	Aervalanata (Mountain knot grass)	Aqueous, ethanolic&Aqueous ethanolic extract	Doxorubicin Induced Cardiomyopathy in Rats	These extracts prevented the doxorubicin induced myocardial toxicity by boosting the enzymatic and non-enzymatic antioxidant activity.
13.	BombaxceibaL. (Silk cotton tree)	Root powder	Cardiovascular risk parameters in patients with Ischemic heart diseases.	The effect on serum lipids, plasma fibrinolytic activity and antioxidant potentials of the root powder was evaluated in individuals with Ischemic heart disease.
14.	Corchorusaestuans (East Indian Mallow)	Fruit extract	Cardiotonic activity of isolated cardiac glycoside	The beneficial effect of the fruit extract showed a therapeutic effect without any cardiac arrest.
15.	Ocimumbasilicum (basil)	Ethanollic extract	isoproterenol induced myocardial infarction in rats	The effect of short term administration of hydroalcoholic extract protects the myocardium against isoproterenol induced infarction.
16.	GrapeseedProanthocyanidin	Grapeseedextract	Doxorubicin Induced Myocardial Injury in rats	The antioxidant and cardioprotective effect of grapeseed in cardioprotection against doxorubicin induced myocardial injury was studied.
17.	Phyllanthusamarus (Carry me seed) &Phyllanthusfraternus (Gulf leaf flowwer)	Ethanol-water extract and Water extrtact	Cardiovascular activity was evaluated by using isolated frog heart perfusion	The effect of both the plant was evaluated by improving the function of hypodynamic heart.

			technique.	
18.	Parkiabiglobosa (Locust bean)	Stem bark extract	Isoproterenol Induced Myocardial Infarction in Rats.	The cardioprotective effect of stem bark might be due to antioxidant, antilipoperoxidative and antihyperlipidemic activities.
19.	UrticaparvifloraRoxb(Phlomis)	Ethanollic extract	Isoproterenol Induced Myocardial Infarction in Rats.	The present study demonstrates the development of oxidative cardiac injury induced by isoproterenol and the extract prevented cardiotoxicity by boosting the endogenous antioxidant activity.
20.	Hemidesmusindicus (Indian sarasaparilla)	Root extract	doxorubicin - induced oxidative stress in mice	The root extract exhibits chemo protector against doxorubicin induced cardiotoxicity due to its non toxicity and it boost the antioxidant capacity of the heart.
21.	Cassia tora (Sickle senna)	Leaves extract	Isoproterenol Induced Myocardial Injury	This study showed the pretreatment of leaf extract is very effective against Isoproterenol Induced Myocardial Injury.
22.	Coconut water	Coconut water	Doxorubicin Induced Cardiomyopathy	Coconut water posses a beneficial antioxidant and cardioprotective activity.
23.	Caesalpinia crista Linn (Fever nut)	Ethanollic and aqueous extract	Isoproterenol Induced Myocardial Necrosis in Rats.	Pretreatment of alcoholic and aqueous extract was evaluated for protection against isoproterenol induced myocardial infarction.
24.	Croton sparciflorus (Ban tulasi)	methanollic extract	Isoproterenol Induced Myocardial Infarcted Wistar Albino Rats.	This study showed cardiprotectivity by lowering the serum levels of different biochemical parameters
25.	SyzygiumAromaticum (Clove)	methanollic extract	Isoproterenol Induced Myocardial Infarction in Rats.	The study of extract of flower bud showed a beneficial action for functional recovery of the heart and restoration of biochemical and tissue enzyme alterations.
26.	Buchananiaaxillaris(cuddapah almond)	Methanollic leaf extract	Doxorubicin Induced Cardiotoxicity in albino Rats	Ethanollic leaf extract showed significant biochemical and histopathological parameters to protect heart in Doxorubicin treated rats.
27.	Lagenariasiceraria (Bottle guard)	Ethanol extract	Evaluation of cardiotonic action on frog's heart	Cardiotonic action of ethanol extract had been confirmed through force of contraction and heart rate.
28.	Medicago sativa (Alfalfa)	Ethanollic extract	Isoproterenol Induced Myocardial Infarcted Wistar Albino Rats	Administration of ethanollicextract reduced the myocardial damage extensively, this activity is due to the presence of phytochemicals and antioxidants.

29.	Terminaliabelerica (BelliricMyrobalan)	Ethanollic extract	Isoprenaline Induced Myocardial Necrosis in Rats	Ethanollic extract showed a significant ability to strengthen the myocardial membrane by its membrane-stabilising action
30.	Curcumin and Ficusbenghalesis (Banyan)	methanol bark extract	Doxorubicin Induced Myocardial toxicity in albino Rats	Antioxidant properties of curcumin and Ficusbenghalesis extract caused cardioprotective and Anti-proliferative, anti-initiation and free radical scavenging properties might boost myocardial integrity
31.	Lavandulaangustifolia (English lavender)	Essential oil	Isoproterenol-induced Acute Myocardial Infarction in Rat	The present study demonstrates that the essential oil protects the myocardium by normalizing ECG and strengthen the myocardial membrane
32.	Crataegusaronia (Spiny hawthorn)	Aqueous extract	Doxorubicin-Induced Cardiotoxicity and Heart Failure in Wistar Rats	The aqueous extract improve the damage to cardiac tissue by modulating cardiotoxicity
33.	Boswelliacarteri (Frankincense)	Oleogum resin-olibanum	cardioprotective and antioxidant activity in wistar male albino rats	The cardioprotective effect of methanol extract revealed a mild cardioprotective effect and weak antioxidant activity.
34.	Tinosporacordifolia (heartleaf moonseed)	Root extract	Isoprenaline Induced Myocardial Infarction in Rats	Pretreatment with methanolic extract reduce isoprenaline induced myocardial infarction and the cardioprotective strengthen the myocardial membrane
35.	Hibiscus sabdariffa (Rosale)	Methanolic extract	Cardioprotective and anti-inflammatory activities in wistar rats	Both the cardioprotective and anti-inflammatory activities had been evaluated in the methanolic extract.
36.	Citrus grandis(L.) (Pomelo)	Ethanollic extract	Doxorubicin and Cyclophosphamide Induced Cardiotoxicity in Albino Rats	Administration of ethanollic extract showed protection against Doxorubicin and Cyclophosphamide Induced Cardiotoxicity and it exerted protective effect due to lipid lowering and antioxidant property
37.	Allium humile (Small alpine onion)	Methanolic extract	Cardioactive Principle on Global Ischaemic Rat Heart	The present investigation was undertaken to study the efficacy of active principle of methanolic extract and it prevented myocardial infarct size
38.	TrianthemaportulacastrumLinn (desert horsepurslane)	Plant extracts	Gentamicin and Isoproterenol Induced Experimental Rats	The oral administration of Trianthemaportulacastrum showed a remarkable protection on nephroprotective, anti-oxidant, cardio protective effect

39.	Theobroma Cocoa (Cocoa tree)	Hydroethanolic crude extract	Isoproterenol Induced Myocardial in Rat	50% hydroethanolic extract was orally administered and observed the cardioprotective action
40.	Newbouldialaavis (Boundary tree)	Leaf and root extracts	Carbon Tetrachloride Induced-Cardiotoxicity in Albino Rats	The antioxidant property of the leaf and root extract showed cardioprotective potential

Biochemical estimations

Some of the biochemical estimation for the cardioprotection activity was analysed by some methods and in which electrocardiogram was recorded first and blood was analyzed for Creatine Kinase-MB isoenzyme (CK-MB) and Aspartate aminotransferase (AST) activities. Different cardiac variables including Left ventricular developed pressure (LVDP), Heart rate (HR) and Coronary flow (CF) were measured. Determinations of Superoxide dismutase (SOD), Reduced glutathione (GSH), Lipid peroxidation (LPO), Rate pressure product (RPP) was calculated, and released lactate dehydrogenase (LDH) enzyme in effluent was measured in reperfusion and histopathology of the heart tissues were carried out in evaluating the cardioprotection in the plants⁴⁻⁴³ from the list (Table 2).

CONCLUSION

The present review has accentuate on the effects of cardiovascular disease, the cardioprotective phytoconstituents present in the plants, the various biochemical estimations and several in-vitro, in-vivo and human studies carried out in the papers. The brief survey of literature evidences us that the traditional medicinal plants have no known side effects and the presence of cardioprotective bioactive compounds in plant extracts. These reviews paved us a way for the further work to isolate the bioactive

compounds from various plants and determine their biological activities.

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