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CARDIO-PROTECTIVE PLANTS PRESENT IN WEST GODAVARI DISTRICT OF ANDHRA PRADESH, INDIA: A SHORT REVIEW

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ABSTRACT: Cardiac diseases are responsible for more number of deaths in India and the rest of the world. There are various synthetic drugs which are being used for cardiac diseases. The limitation of synthetic drugs is most of them shows anarchic side effects to human systems. Medicinal plants are gaining a lot of importance nowadays because of efficacy they have been showing in the traditional healing. Plants are the exemplary source of inhibitors for various diseases. In this short review an attempt has been made to review the Medicinal plants which have potent cardioprotective activity that is present in the west godavari district of Andhra Pradesh, India such as *Daucus carota*, *Hibiscus rosa sinensis*, *Bacopa monneira*, *Moringa oleifera*, *etc*., of about 10 plants were reviewed and their photographs have also been included in this review.

INTRODUCTION: Heart diseases are increasing day by day in India and rest of the World. Most of the deaths in India are due to heart disorders besides deadly cancer. If current trends are allowed to continue, by 2030 an estimated 23.6 million people will die from cardiovascular disease [1]. Cardiovascular diseases include: coronary heart disease (heart attacks), cerebrovascular disease, raised blood pressure (hypertension), peripheral artery disease, rheumatic heart disease, congenital heart disease, and heart failure [1]. Therapeutic drug categories in CVD include antianginal drugs, anticoagulants, diuretics, antiarrhythmic drugs, hypotension and anticholesterol drugs [2].

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For cardiovascular diseases, herbal treatments have been used in patients with congestive heart failure, systolic hypertension, angina pectoris, atherosclerosis, cerebral insufficiency, venous insufficiency and arrhythmia [3]. The best source of drugs without hazardous effect to human systems could be the plant source, and this has been proved by the Traditional healing system and the recent studies conducted on the experimental animals [4].

More than 2000 plants have been listed in the Traditional systems of medicine, and some of these are providing comprehensive relief to the people suffering from cardiovascular diseases, especially "hyperlipidemia" and "ischemic heart disease" [5]. Currently, increasing health concern urged the researchers to revitalize the natural products and to alleviate the diseases without harming the body [6]. Medicinal plants are gaining a lot of importance nowadays because of efficacy they have been showing in the traditional healing [7]. Even expansion of modern medicines throughout the

India people in rural areas still uses this wonder Herbal medications for various sorts of diseases.

Different Heart Diseases: [8] World heart federation classified Heart diseases into different types. They are Rheumatic heart disease, Hypertensive heart disease, Ischemic heart disease, Cerebrovascular disease, Inflammatory heart disease, and Others.

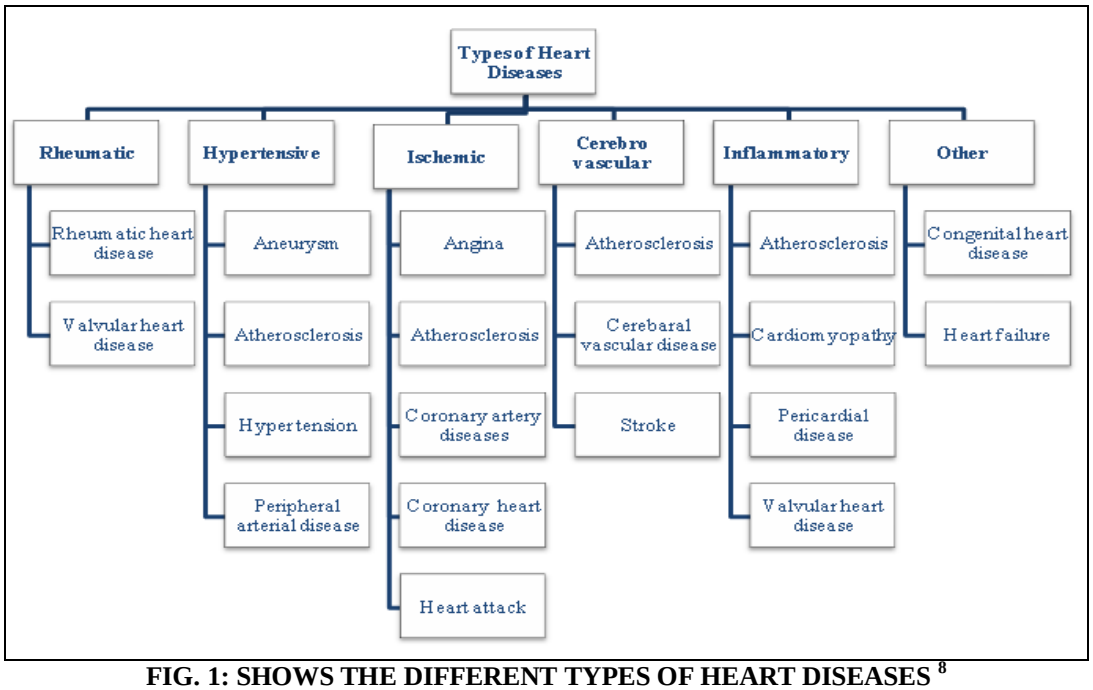

FIG. 1: SHOWS THE DIFFERENT TYPES OF HEART DISEASES [8]

Causes of Heart diseases: [9] Healthline.com has given some of the main causes of heart diseases; they are cholesterol, smoking, and high blood pressure. Accumulation of cholesterol in blood vessels leads to plaques that cause obstruction. Nicotine affects oxygen and can cause vessels narrow.

Cardio-Protective Herbs:

***Daucus carota* (Umbelliferae):** *Daucus carota* Linn. tubers were extracted with water and analyzed for its inotropic and cardioprotective effects by measuring various biochemical parameters at the test doses of 250 and 500 mg/kg. Isoproterenol (5.25 mg/kg and 8.5 mg/kg) was administered subcutaneously on 29th and 30th day respectively to induce myocardial infarction. Cardiac tonicity was estimated by evaluating Na^+ K^+ ATPase, Mg^{2+} ATPase and Ca^{2+} ATPase levels in the heart. The levels of Na^+ K^+ ATPase and Mg^{2+} ATPase were decreased and that of Ca^{2+} ATPase was increased in extract-treated group significantly ($p<0.001$). Cardioprotection was assessed by estimating serum aspartate transaminase, alanine transaminase, lipid peroxidase, and lactate dehydrogenase levels and total cardiac protein and lipid peroxidase, and lactate dehydrogenase. The levels altered by isoproterenol were restored significantly by the administration of the extract. The result of the study implies that *D. carota* is a potential source to protect the heart from myocardial infarction and to maintain its tonicity [10].

FIG. 2: *DAUCUS CAROTA*

***Hibiscus rosa sinensis* (Malvaceae):** The medicinal values of the flowers of *Hibiscus rosa sinensis* (Chinese rose) have been mentioned in ancient literature as useful in disorders of the heart. Dried pulverized flower of *Hibiscus rosa sinensis* was administered orally to Wistar albino rats (150-

200 gm) in three different doses [125, 250 and 500 mg/kg in 2% carboxymethyl cellulose (CMC)], 6 days per week for 4 weeks. Thereafter, rats were sacrificed; either for the determination of baseline changes in cardiac endogenous antioxidants [superoxide dismutase, reduced glutathione and catalase] or the hearts were subjected to isoproterenol induced myocardial necrosis. It may be concluded that flower of *Hibiscus rosa sinensis* (250 mg/kg) augments endogenous antioxidant compounds of rat heart and also prevents the myocardium from isoproterenol induced myocardial injury [11].

FIG. 3: *HIBISCUS ROSA SINENSIS*

***Ocimum sanctum* (Labiatae):** Panda VS, Naik SR investigated the cardioprotective activity of a combined treatment of *Ginkgo biloba* phytosomes (GBP) and *Ocimum sanctum* extract (Os) in isoproterenol (ISO)- induced myocardial necrosis in rats. Significant myocardial necrosis, depletion of the endogenous antioxidants superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPx), glutathione reductase (GR), and glutathione (GSH), and increases in the serum marker enzymes aspartate aminotransferase (AST), lactate dehydrogenase (LDH), and creatine phosphokinase (CPK) were observed in ISO-treated rats compared with normal rats. Co-administration of GBP (100 mg/kg) with Os at two doses (50 and 75 mg/kg) for30 days to rats treated with ISO (85 mg/kg, SC) on the 29th and 30th days demonstrated a significant decrease in ISO-induced serum marker enzyme elevations and a significant attenuation of the ISO-elevated myocardial lipid peroxidation marker malondialdehyde (MDA). They concluded that GBP-Os oral treatment to ISO-challenged rats demonstrates significant cardiac protection, decreases lipid peroxidation, and restores antioxidant activities [12].

FIG. 4: *OCIMUM SANCTUM*

***Bacopa monneira* (Scrophulariaceae):** The effects of a standardized hydro-alcoholic lyophilized extract of *Bacopa monneira* (BM) in isoproterenol (ISP)-induced myocardial necrosis were studied. Wistar albino male rats were randomly divided into sham, ISP control and *Bacopa monneira* treated groups. *Bacopa monneira* was administered in doses of 50, 100, 150 or 200 mg kg^{-1} orally for 30 days to *Bacopa monneira* treated groups while sham and ISP control groups received saline orally for the same duration. On day 29 and 30, ISP (85 mg kg^{-1}) was administered subcutaneously at an interval of 24 h to ISP control and *Bacopa monneira* treated groups. On day 31, hemodynamic parameters were recorded before all rats were sacrificed. Hearts were excised and processed for biochemical, histopathological and ultrastructural assessment.

Significant cardiac dysfunction, decline in endogenous antioxidant defence [superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GSHPx) and reduced glutathione (GSH)], myocyte-specific injury markers [myocardial lactate dehydrogenase (LDH) and creatine kinase-MB (CK-MB) isoenzyme] as well as increase in lipid peroxidation marker [malonaldialdehyde (MDA)] were observed in ISP control group as compared to sham control. Of the different doses studied, *Bacopa monneira* (150 mg kg^{-1}) produced maximum cardioprotection as evidenced by significant restoration of endogenous antioxidants, myocardial LDH and CK-MB isoenzyme activities and the decrease in MDA[13].

FIG. 5: ***BACOPA MONNEIRA***

Moringa oleifera **(Moringaceae):** Nandave M *et al.*, evaluated cardioprotective effect of lyophilized hydroalcoholic extract of *Moringa oleifera* in the isoproterenol (ISP)-induced model of myocardial infarction. Wistar albino male rats were divided into three groups and orally fed saline once daily alone (sham) or with ISP (ISP control) or ISP with *M. oleifera* (200 mg/kg), respectively, for 1 month. On days 29 and 30 of administration, rats of the ISP control and *M. oleifera*-ISP groups were administered ISP (85 mg/kg, SC) at an interval of 24 hours. On day 31, hemodynamic parameters (mean arterial pressure [MAP], heart rate [HR], left ventricular end-diastolic pressure [LVEDP], and left ventricular peak positive [(+) LV dP/dt] and negative [(-) LV dP/dt] pressures were recorded. Moringa treatment significantly prevented the rise in lipid peroxidation in myocardial tissue. Furthermore, *M. oleifera* also prevented the deleterious histopathological and ultrastructural perturbations caused by ISP. They concluded that *M. oleifera* extract possesses a significant cardioprotective effect, which may be attributed to its antioxidant, antiperoxidative, and myocardial preservative properties [14].

FIG. 6: ***MORINGA OLEIFERA***

Allium sativum **(Liliaceae):** A study was conducted to elucidate the antioxidant role of garlic oil in isoproterenol (IPL)-induced myocardial infarction in rats. In myocardial necrosis induced by isoproterenol, a significant increase in serum iron content with a significant decrease in plasma iron binding capacity, ceruloplasmin activity, and glutathione (GSH) level was observed. There was also a significant increase in lipid peroxides levels on isoproterenol administration. Activities of antioxidant enzymes like superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPX), glutathione-S-transferase (GST) and glutathione reductase (GRD) were decreased significantly in the heart with isoproterenol-induced myocardial necrosis. Garlic oil produced a marked reversal of these metabolic changes related to myocardial infarction induced by isoproterenol. In conclusion, garlic oil exerts its effects by modulating lipid peroxidation and enhancing antioxidant and detoxifying enzyme systems [15].

FIG. 7: ***ALLIUM SATIVUM***

Psidium guajava **(Myrtaceae):** Yamashiro S *et al.*, determined whether the medicinal herbs growing in Okinawa and possessing a radical-scavenging activity would exert cardioprotective effects against ischemia-reperfusion injury using isolated perfused rat hearts. Effects of the aqueous extracts from *Psidium guajava* L. and *Limonium wrightii* at concentrations having an equipotent radical-scavenging activity on myocardial injury produced by global ischemia followed by reperfusion were tested and were further compared with those of quercetin and gallic acid, major antioxidative components of *P. guajava* L. and *L. wrightii*, respectively. Both extracts significantly attenuated ischemic contracture during ischemia and improved myocardial dysfunction after reperfusion.

Decreases in high-energy phosphates and increases in malondialdehyde in the reperfused hearts were significantly lessened with both plant extracts. Quercetin and gallic acid also exerted similar beneficial effects.

These results indicate that *P. guajava* L. and *L. wrightii* both have cardioprotective effects against myocardial ischemia-reperfusion injury in isolated rat hearts, primarily through their radical-scavenging actions [16].

FIG. 8: ***PSIDIUM GUAJAVA***

Calotropis procera **(Asclepediaceae):** The alcoholic extract of the latex obtained from *Calotropis procera* (Asclepiadaceae) was evaluated for protection against isoproterenol (20 mg/100 g body wt., SC)-induced myocardial infarction in albino rats. The heart damage induced by isoproterenol was indicated by elevated levels of the marker enzymes such as Creatine Kinase-isoenzyme (CK-MB), lactate dehydrogenase (LDH), serum glutamate oxaloacetic transaminase (SGOT) and serum glutamate pyruvate transaminase (SGPT) in serum with increased lipid peroxide and reduced glutathione content in heart homogenates.

Microscopical examination (histopathology) was also performed on the myocardial tissue. Pretreatment with an ethanolic latex extract of *Calotropis procera* at a dose of 300 mg/kg body wt., administered orally thrice a day for 30 days, reduced significantly ($p<0.01$) the elevated marker enzyme levels in serum and heart homogenates in isoproterenol-induced myocardial infarction. Histopathological observation revealed marked protection by the extract in myocardial necrotic damage [17].

FIG. 9: ***CALOTROPIS PROCERA***

Azadirachta indica **(Meliaceae):** Peer PA *et al.*, evaluated the cardioprotective potential of aqueous leaf extract of *Azadirachta indica* A. Juss. (AI) by hemodynamic, biochemical and histopathological parameters in isoprenaline-induced myocardial infarction in rats and to compare with vitamin E, a known cardioprotective antioxidant. A significant ($p<0.01$) decrease in mean arterial blood pressure (MAP), systolic arterial blood pressure (SAP), diastolic arterial blood pressure (DAP) and increase in heart rate (HR) were observed in isoprenaline control group. Isoprenaline showed a significant decrease in the level of cardiac marker enzymes [Lactate dehydrogenase (LDH) and Serum Glutamate Oxalotransaminase (SGOT)] in the heart homogenate with a corresponding increase in their level in serum.

In vitamin E control group significant ($p<0.05$) increase in LDH in heart homogenate and a decrease of SGOT and LDH in serum was observed. In the isoprenaline control group, significant ($p<0.01$) increase in total cholesterol and triglycerides levels while decrease in high-density lipoproteins (HDL) was observed.

On histopathological examination, myocardial damage in isoprenaline control group further confirmed the cardiotoxic effect of isoprenaline. Our data showed that AI (250, 500 and 1000 mg/kg, p.o.) and vitamin E (100 mg/kg, p.o.) significantly restores most of the hemodynamic, biochemical and histopathological parameters. Finally, concluded that AI leaf extract exerts equipotent cardioprotective activity in the experimental model of isoprenaline induced myocardial necrosis in rats as compared to vitamin E, a known cardioprotective antioxidant [18].

FIG. 10: ***AZADIRACHTA INDICA***

Mangifera indica **(Anacardiaceae):** Pretreatment with mangiferin (10mg/100g body weight) for 28 days was found to ameliorate the effect of Isoproterenol induced pathological changes, reduced the lipid peroxidation formation and retained the myocardial marker enzyme activities at near normal level. This result indicates the cardioprotective activity of mangiferin against Isoproterenol induced myocardial infarction in rats [19].

FIG. 11: ***MANGIFERA INDICA***

TABLE 1: SHOWS THE PLANTS HAVING CARDIO-PROTECTIVE PLANTS WITH THEIR LOCAL NAMES

S. no.	Plant name	Family	Local Name	Part used	Reference
1	*Daucus carota*	Umbelliferae	Carrot	Tubers	10
2	*Hibiscusrosa sinensis*	Malvaceae	Mamdaram	Flowers	11
3	*Ocimum Sanctum*	Labiatae	Tulasi	Leaves	12
4	*Bacopa monneira*	Scrophulariaceae	Sambrani chetu	-	13
5	*Moringa oleifera*	Moringaceae	Karivepaaku	Leaves	14
6	*Allium sativum*	Lilliaceae	Vellulli	Oil	15
7	*Psidium guajava*	Myrtaceae	Jama chettu	Leaves	16
8	*Calotropis procera*	Asclepediaceae	Jilledu	Latex	17
9	*Azadirachta indica*	Meliaceae	Vepa	Leaves	18
10	*Mangifera indica*	Anacardiaceae	Mamidi	Mangiferin	19

CONCLUSION: Always the natural drugs are superior to the synthetic drugs in terms of healing as well as efficacy. Cardiac diseases are the main cause of deaths in Andhra Pradesh after cancer. There is an urgency for effective drugs without hazardous effects on human systems. The above-mentioned plants proved to be cardioprotective. Hence, the scientific community should do extensive and intensive work for finding herbal-based drugs for cardiac diseases.

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CONFLICT OF INTEREST: Nil

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