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Review Article

**A REVIEW BASED ON PLANT DERIVED CARDIO VASCULAR  
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Department of Pharmaceutics. Bapatla College of Pharmacy Bapatla -522101.**Abstract:**

*Cardiovascular diseases (CVDs) pose a significant global health burden, with rising prevalence and mortality rates. Amidst this, medicinal herbs have gained popularity as an alternative treatment approach due to their cost-effectiveness and perceived safety. However, their safety and efficacy require rigorous testing. This review addresses the therapeutic potential of herbs in CVD management, focusing on four widely used plants: Ginseng, Ginkgo biloba, Ganoderma lucidum, and Gynostemma pentaphyllum. We examine their ethnopharmacological properties, cardio-protective mechanisms and clinical trial outcomes, highlighting efficacy, safety and toxicity. Our analysis encompasses various CVDs, including myocardial infarction, hypertension and coronary heart disease. Herbal medications are widely used for various clinical purposes, including cardiovascular treatment, despite lacking rigorous clinical testing and regulatory approval. Unlike conventional medications, herbs are often marketed without proven efficacy and safety. This review examines the evidence surrounding herbal medications commonly used in cardiovascular medicine, revealing a significant gap between their potential biological effects and clinical benefits. While some herbs demonstrate cardiovascular relevance, robust clinical data are scarce. Concerns persist regarding potential side effects, drug interactions and contamination risks. Healthcare providers must counsel patients on herbal medication use, weighing potential benefits against uncertain risks and emphasizing informed decision-making.*

*Key Words:* Herbal medicine, cardiovascular diseases, atherosclerosis, hypertension, medicinal plants.

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**INTRODUCTION:**

Cardiovascular diseases (CVDs) encompass a range of conditions impacting the heart and blood vessels [1]. Hypertension stands out as a primary risk factor, with widespread prevalence. Dyslipidemia, stemming from abnormal lipid metabolism, also significantly contributes to CVD development. This umbrella term covers various conditions, including hypertension, dyslipidemias, cardiomyopathies, stroke, coronary heart disease, heart failure and peripheral vascular diseases. CVDs have emerged as a pressing global health concern, leading to substantial mortality and morbidity. Over the past few decades, they have consistently ranked as the top cause of death worldwide. Notably, women face higher mortality rates and poorer outcomes following acute cardiovascular events, such as coronary heart disease, stroke and heart failure. According to World Health Organization projections, CVD-related deaths are expected to reach 22.2 million by 2030, underscoring the urgent need for effective prevention and management strategies. The limitations of conventional cardiovascular medications, including adverse side effects and high costs, have fueled the quest for innovative treatments. Medicinal plants have emerged as a vital solution, offering a safer, more affordable and potent alternative for managing cardiovascular diseases (CVDs). The growing recognition of herbal medicine's benefits has led to its widespread acceptance in medical practice. Phytochemicals and plant-based diets have shown remarkable promise in preventing CVDs. Traditional herbal remedies have been successfully employed to address various cardiovascular conditions, such as arrhythmia, heart failure and atherosclerosis. Furthermore, regular physical activity is recognized as a valuable complementary approach to safeguarding cardiovascular health. Advances in research have revealed the efficacy of natural compounds in combating cardiovascular disease (CVD) factors, particularly oxidative stress and inflammation. Medicinal plants' therapeutic properties stem from their bioactive constituents, such as carotenoids, polyphenols and flavonoids. These phytochemicals have demonstrated potential in preventing CVD. Epidemiological studies and clinical trials underscore the importance of diet in mitigating cardiovascular risk. Diets rich in polyunsaturated and monounsaturated fats, as well as phytochemical-dense foods, have been shown to reduce CVD incidence and improve lipid profiles. Notably, consuming insoluble polyphenols has been found to decrease the LDL-C/HDL-C ratio, a key predictor of CVD risk.

Medicinal plants have demonstrated cardioprotective effects by safeguarding various cell types, including macrophages, cardiomyocytes and endothelial cells, against damage. Their mechanisms of action encompass antioxidant, anti-inflammatory, anticoagulant, hypolipidemic, hypotensive and diuretic properties. Antioxidants mitigate cardiovascular disease by neutralizing free radicals, while anti-inflammatory activities, such as modulating IKK- $\beta$  kinase, inhibit harmful inflammation. Anticoagulants prevent thrombotic events, including strokes and acute coronary syndromes. Hypolipidemic agents reduce lipid and lipoprotein levels, alleviating the risk of coronary artery disease, heart attacks and strokes. Despite progress, the molecular mechanisms underlying herbal medicines' cardioprotective effects require further investigation. Additionally, potential adverse effects and drug interactions necessitate cautious consideration when implementing herbal remedy regimens. Emerging research on phytochemical nano formulations shows promise in preventing and treating cardiovascular diseases[2].

**CARDIOVASCULAR DISEASES:**

Cardiovascular disease (CVD) reigns as the world's leading cause of death and morbidity, claiming 17.9 million lives annually. This staggering toll exceeds breast cancer deaths among women. Globally, CVD accounts for 30% of fatalities, with Europe bearing 45% of these deaths. The World Health Organization and American Heart Association report alarming statistics: one death every 36 seconds in the US, 659,000 annual heart disease deaths, and over 50% of the US population affected [3]. Low- and middle-income countries, like Sub-Saharan Africa, face an escalating CVD epidemic, with women disproportionately affected. Aging populations, high blood pressure, atherosclerosis, smoking, obesity and physical inactivity fuel this crisis. By 2030, CVD's burden in Sub-Sahara countries is expected to double [4]. As the primary cause of death in developing nations, CVD demands urgent attention to mitigate risk factors and improve cardiovascular health. Plant derived phytochemicals in prevention and treatment of CVD:

Natural products and herbal remedies are widely there and used in preventing or treating cardiovascular diseases [5]. Natural product used remedies are very safe and effective when compared to current standards treatments. Based on these facts' world decided to use various medicinal plants to treat cardiovascular disease. Likewise many medicinal plant parts that are used are aerial parts of *Achillea arabica*, the root, leaf

,and the stem part of *Ageratum conyzoides*, leaves, stalks, and stem of *Artemisia absinthium*, flowers of *chrysanthemum x morifolium* and leaves of *Clerodendrum volubile* have been use more to treat cardiovascular diseases. Some terrestrial plants that are used such as *Terminilia arjuna*, *Ocimum sanctum*., *Allium cepa* (onion), *curcuma longa* L., *commiphora*

*mukul*, *Trigonella foenum -graecum* L., and *allium sativum* L. have been very fond of using to possess cardio protective activities[6].

Some of the cardio-protective activities of medicinal plants against cardio toxicity produced by various agents are given in the following table:

S. N O	TRADITIONAL NAME	PLANT NAME	FAMILY	SOURCE	CHEMICAL CONSTITUENTS	ACTIONS	REFERENCE
1	Garlic	<i>Allium sativum</i>	Liliaceae	Bulb	Alkaloids, flavonoids, tannins, saponins, and cardiac glycosides	Antimicrobial, antihyperlipidemic and cardio protective	[7]
2	Hairy fig	<i>Ficus hispida</i>	Moraceae	leaves	Alkaloids, terpenes, saponins, glycosides, mucilage, gums, flavonoids, phenols, sterols, amino acids, protein, carbohydrates, lupeol acetate, gluanol	Cardioprotective, antipyretic, hepatoprotective, anti-inflammatory	[7]
3	Kerala ginseng, ginseng of Kani tribes	<i>Trichopus zeylanicus</i>	Trichopodaceae	leaves	Alkaloids, glycosides, flavonoids, steroids, tannins, terpenoids	Cardioprotective, adaptogenic, aphrodisiac	[7]
4	coriander	<i>Coriandrum sativum</i>	Apiaceae	seeds	Essential oils and polyphenols	Controls diabetic dyslipidemia to prevent cardiovascular complications	[8]
5	Turmeric	<i>Curcumina longa</i>	Zingiberaceae	Rhizome	curcumin	Cardioprotective, effects through reducing oxidative stress	[7]
6	Kalmegh	<i>Andrographis paniculata</i>	Acanthaceae	Leaves	Andrographolide, diterpenoids, flavonoids, quinic acid, xanthenes, noriridoids and andrographidoids A, B, C, D and E	Cardioprotective, gastroprotective, antioxidant	[7]
7	Zafran, saffron	<i>Crocus sativus</i>	Iridaceae	Flowers	Carotenoid compounds, crocetin, crocin, safranal, glucoside, picrocrocin, anthocyanins, delphinidin, petunidin,	Cardioprotective, hypnotic, anxiolytic, anticancer	[7]

9	Tulsi	Ocimum sanctum	Lamiaceae	seeds	Alkaloids, saponins, tannin, flavonoids, terpenoids, steroid,	Cardioprotective, antioxidant, hypolipidemic, hypoglycemic	[7]
10	Maidenhair tree	Ginkgo biloba	Ginkgoaceae	leaves	Flavonoids, and terpenoids	Promotes cardiomyocyte survival and inhibits cardiomyocyte apoptosis	[8]
11	Moringa, drumstick tree	Moringa oleifera	moringaceae	leaves	Tannins, saponins, alkaloids, terpenes, carbohydrates, flavonoids, and cardiac glycosides, sterols, flavonoids, terpenoids, and saponin	Anticancer, anti-inflammatory, antipyretic, and cardioprotective	[7]
12	Bottle guard	Lagenaria siceraria	Cucurbitaceae	Fruit	Sterols, flavonoids, terpenoids, and saponin	Antioxidant, anti-inflammatory and cardioprotective	[7]
13	Ginger	Zingiber officinale	Zingiberaceae	rhizome	6-shogal, 6-gingerol, 8-gingerol, and 10-gingerol	Enhances fibrinolytic activity and decreases lipid peroxidation, controls blood glucose levels.	[8]
14	Ban, Tulasi, raan tulasskoli	Croton sparsiflorus	Euphorbiaceae	leaves	Terpenoids, saponins, tannins, phenols, flavonoids, alkaloids	Antinociceptive, anti-inflammatory cardioprotective	[7]
15	Neem tree, Indian lilac	Azadirachta indica	meliaceae	leaves	Reducing sugar, tannins, flavonoids, steroids, terpenoids, glycosides and alkaloids	Cardioprotective, chemo preventive, antiplasmodial, anti-inflammatory	[7]
16	Tomato	Solanum lycopersicum	solanaceae	fruit	Favanoids	Reduces the risk of human cardiovascular diseases through lowering blood pressure and monitor type 2 diabetes	[8]
17	Black cumin	Nigella sativa	Ranunculaceae	seeds	Cinnamaldehyde	Decreases oxidative stress and regulates avert hypertension development	[8]

### BIOACTIVE COMPOUNDS USED IN THE TREATMENT OF CVD'S:

Polyphenols, flavonoids, terpenoids, alkaloids, quinones, plant sulfur compounds are the major bioactive compounds that are used to treat cardiovascular diseases [9]. They have a greater capacity which reduces low density lipoproteins oxidation and increases lipid profile and regulates the

apoptotic process in the endothelium [10]. The antioxidant property of bioactive compounds deliberates their therapeutic applications for a very wide range of chronic diseases including diabetes, liver diseases and as well as cardio vascular disease (CVD'S)

Mechanism of action of some medicinal plants for CVD's treatments: [11-13]

S.NO	PLANT	PHYTOCONSTITUENTS	MECHANISM OF ACTION
1.	Curcuma longa	Fat-soluble aromatic Phyto extract that obtained from ginger plant and rhizome curcumin	Controls hypertensive effects (1) by lowering bp, it can increase myocardial trophic blood flow (2) by reducing the viscosity of blood and thrombosis formation through hindering the synthesis of thromboxane A2. It also prevents platelet activation and aggregation by (1) by protecting and activating vascular endothelial cells from incapacitation which reduces the thrombosis and abnormal BP
2.	Moringa oleifera	Flavonoids, glucomoringin, $\beta$ - sitosterol, sulphur-containing compounds niazimin-A, niaziminin-B, and niazicin-A	Targets angiotensin converting enzyme (ACE) (1) through anti-hypertensive activity (2) treats obesity and its cardioprotective effects (3) regulates the cardiac induced by a high-fat-diet feeding
3.	Nigella sativa	Alkaloids, flavonoids, and thymoquinone	Prevents cell injuries (1) by reducing the free radical formation (2) by scavenging free radical species from blood

### Herbal remedies in the management of cvd's:

Since the dawn of human civilization, plants have played a vital role in society, offering both culinary and medicinal benefits. These plant-based products, known as nutraceuticals, blend nutrition and pharmaceutical properties. The FDA notes that over 50% of clinically used drugs originate from natural sources, such as Ephedra sinica Stapf, foxglove, willow bark, Rauwolfia serpentina and Pacific yew tree. Plant-based nutraceuticals have garnered significant attention due to their exemplary safety profile, natural origin and long-term tolerability. These attributes make them ideal complementary agents to conventional medications in managing cardiovascular disease (CVD) risk factors. Their popularity stems from the potential to mitigate CVD risks without adverse effects, promoting a holistic approach to health.

Nutraceuticals exhibit multifaceted benefits, targeting various pro-atherogenic changes. Research highlights plant-based nutraceuticals and herbal products as valuable adjuncts in cardiovascular disease (CVD) management. Their antioxidant properties delay coronary artery disease (CAD) progression by inhibiting LDL cholesterol oxidation and preventing ischemia/reperfusion damage. Enhanced nitric oxide levels improve vascular and endothelial function. Anti-inflammatory effects counter atherosclerosis, vascular plaque formation and myocardial remodeling. Additionally, natural products with anti-atherogenic properties beneficially modulate blood lipid profiles. Herbal formulations offer further advantages, including anti-apoptotic effects, anticoagulant activity, vasodilation and diuretic properties. Amidst rising

chronic illness risks, plant-based products have garnered significant attention in CVD management.

The cardioprotective potential of herbs and natural products has been extensively explored (Maridass et al., 2008; Das et al., 2012; Patridge et al., 2016). Notably, an Ayurvedic herbal combination pill, featuring Guggulu, Arjuna, Lasuna, Amalaki, Pushkarmoola and Jatamansi, has been developed to manage CVDs, leveraging these proven therapeutic agents [14].

#### Cardioprotective herbs and nutraceuticals used for hypertension:

Hypertension or blood pressure is one of the most important risk factors for CVD'S in the world today where it causes a premature death worldwide. Totally every year about 1.13 billion people are estimated to be afflicted or struggling from hypertension which is also known as lurking hazard which significantly contribute to morbidity and mortality.

Various physiological and pathological factors contribute to blood pressure irregularities, including excessive reactive oxygen species (ROS) production, sympathetic nervous system overactivity, endothelial dysfunction, obesity-related hypertension, impaired sodium excretion, fluid retention, renin-angiotensin-aldosterone system (RAAS) activation and vascular smooth muscle alterations (Virdis et al., 2011). To combat hypertension, healthcare providers have multiple antihypertensive drug classes at their disposal, enabling personalized combination therapies to effectively manage blood pressure elevations. However, the efficacy of these treatments is often hindered by the presence of resistant hypertension. Because of availability of earlier referenced medications only 34% people or patients can be able to manage hypertension. The cost, side effects, low patient compliance with required dose are responsible for this situation.[15]

#### Anti-hypertensive medicinal plants and herbs:[16]

S.NO	SCIENTIFIC NAME	THERAPEUTIC SUBSTANCES	SOURCE	PHARMOCOLOGICAL EFFECT
1.	Allium sativum	rich in sulphur compound known as allicin derivative of the amino acid cysteine	Underground stem	Anti hyperlipidemia the prevention of CVD in addition to its hypotensive effect
2.	Beta vulgaris	Betalains, flavonoids, polyphenols, and saponins	roots and leaves	Anti-hypertensive actions of beetroot juice
3.	Camellia sinensis	Catechins (flavon-3-ol) polyphenolic content	Leaves and leaf buds	Anti-inflammatory, anti-diabetic, and anti-hypertensive actions
4.	Hibiscus sabdariffa	Anthocyanins (polyphenolic compounds) and hibiscus acid	flowers	BP-lowering effects due to the no increased production
5.	Nigella sativa	thymoquinone	seeds	Antihypertensive effects
6.	Rouwolfia serpentina	Reserpine (indole alkaloids)	roots	An adrenergic blocking agent antihypertensive activity

#### Cardio protective natural products for ischemic heart disease (IHD) and congestive heart failure (CHF):

Coronary artery constriction, triggered by atherosclerosis, leads to ischemia, depriving cardiac

muscle of oxygen-rich blood, resulting in ischemic heart disease (IHD) or coronary artery disease (CAD). Atherosclerosis, characterized by arterial cholesterol deposition, initiates endothelial dysfunction, reducing nitric oxide and prostacyclin production. Progression

involves leukocyte infiltration, inflammation, plaque formation and vessel thickening, narrowing the lumen and restricting blood flow [17]. Heart failure (HF) ensues when impaired myocardial contraction fails to meet tissue oxygen demands. Contributing factors include ischemic damage.

#### Cardio protective natural products for angina pectoris:

Hemodynamic overload, neuro-humoral imbalance, inflammation, infections and calcium cycling abnormalities. Uncontrolled diabetes and hypertension significantly increase IHD and HF risk. Treatment targets enhanced myocardial contractility, ejection fraction and fluid management. Various cardioprotective herbs and nutraceuticals offer promising approaches for IHD and CHF management. Angina, characterized by insufficient blood flow to the heart muscle, is primarily linked to coronary artery disease (CAD). Traditional treatments focus on symptom relief, slowing disease progression and preventing long-term complications. Plant-based natural products offer potential adjunctive therapies, though their direct impact on angina symptoms

remains unclear. Various botanicals have been explored for angina management, including Hawthorn, Danshen, Panax Noto ginseng, Garlic, Ginkgo biloba, Terminalia arjuna, Inula racemosa, Turmeric, Ligusticum chuanxiong, Commiphora mukul and Trichosanthes kirilowii. While these natural products show promise, their mechanisms of action and effectiveness in treating angina pectoris require further investigation [18].

#### Natural products for cerebrovascular disorder:

Cerebrovascular diseases, including stroke, cerebral edema, vascular dementia and transient ischemic attack, pose significant health risks. Stroke ranks among the leading causes of global mortality and disability. This debilitating condition occurs when brain cells suddenly die due to oxygen deprivation, triggered by disrupted blood flow to the brain. Specifically, stroke results from either arterial blockage or rupture, obstructing cerebral blood flow. The blood coagulation system plays a pivotal role in stroke pathophysiology, highlighting the complex interplay between vascular factors and brain health.[19]

**List of common herbal medicines or remedies used for CVD's:[20]**

S.NO	CVD FORM	EXAMPLES OF HERBAL REMEDIES USED
1.	Atherosclerosis and hyperlipidemia	Allium sativum, commiphora mukul, monascus purpureus
2.	systolic hypertension	Allium sativum, rauwolfia serpentina, nigella sativa, hibiscus sabdariffa, Mentha longifolia
3.	Venous insufficiency	Ruscus aculeatus, aesculus hippocastanum
4.	Cerebral insufficiency	Ginkgo biloba, Rosmarinus officinalis
5.	Angina pectoris	Salvia miltiorrhiza
6.	Congestive heart failure	Digitalis lanata, digitalis purpurea, Salvia miltiorrhiza

Although herbs have been widely used in both traditional and modern medicine a limited number of reviews that gather them and comprehensively focus on their mechanisms of action and safety in the context of CVD'S are present.

#### Global burden of cardiovascular disease:

Cardiovascular diseases (CVD), the leading global cause of mortality, are driven by lifestyle choices, obesity, diabetes mellitus and hypertension. In 2005, CVD claimed 17 million lives, accounting for 30% of global deaths. If unchecked, projected trends suggest 23.6 million CVD-related deaths by 2030. Key modifiable risk factors contributing to coronary heart disease (CHD) and stroke include tobacco and alcohol abuse, hypertension, hypercholesterolemia, obesity, physical inactivity and unhealthy dietary habits.

#### Cardioprotective plants and its brief activities:

Botanical Name: Piper longum

**Cardioprotective Activity:** An investigation assessed the protective effects of Piper longum fruit methanol extract on adriamycin-induced cardiotoxicity in Wistar rats. Adriamycin exposure caused biochemical alterations, tissue peroxidation damage and antioxidant imbalance, accompanied by histopathological changes, including heart tissue degeneration and cellular infiltration. Notably, pretreatment with P. longum extract significantly mitigated these lesions, demonstrating its antioxidant properties and potential to shield against oxidative stress-induced cardiotoxicity.[23]

Botanical name: Zingiber officinale

**Cardioprotective Activity:** Ginger exhibits cardio stimulatory effects, enhancing heart muscle

contraction and promoting blood circulation throughout the body. Increased circulation stimulates cellular metabolism, alleviating cramps and tension. Additionally, ginger helps lower blood pressure and reduce cardiac workload. Its antioxidant properties further contribute to cardiovascular benefits. Research by U. Bhandari et al. demonstrates ginger's protective role against isoproterenol-induced oxidative myocardial damage in rats, highlighting its potential to mitigate cardiac oxidative stress.[24]

Botanical Name: *Allium sativum*

#### Cardioprotective Activity:

Cardiovascular diseases, particularly coronary heart disease, claim more lives than any other condition. The primary culprit is the obstruction of coronary arteries due to plaque accumulation, leading to narrowed arteries, restricted blood flow and oxygen deprivation. This process culminates in heart attacks. Hypertension and hypercholesterolemia are the predominant risk factors. Fortunately, garlic's therapeutic properties directly address these concerns. Research on rabbits demonstrated garlic's remarkable ability to reverse pre-existing atherosclerotic deposits and lesions, highlighting its potential to mitigate coronary heart disease [25].

#### CONCLUSION:

Despite the extensive knowledge on cardiovascular diseases (CVDs), their prevalence continues to rise, underscoring the urgent need for novel, effective, and affordable treatments. Recent *in vitro* and *in vivo* studies demonstrate the potential of four traditionally used medicinal plants in modulating key mechanisms underlying CVD pathogenesis and pathophysiology. These plants exhibit therapeutic properties, alleviating CVD-associated conditions. However, conclusive clinical benefits remain elusive, and safety concerns (e.g., *Ginkgo Biloba*) necessitate caution. Therefore, we advocate for rigorously designed studies and large-scale clinical trials to investigate these plants' mechanisms, efficacy, and safety. Future research must prioritize addressing toxicity concerns to establish these herbal remedies as viable therapeutic alternatives. The use of herbal medications for cardiovascular disease treatment lacks robust scientific backing. While herbs may influence biological mechanisms related to cardiovascular health, existing clinical studies are limited by small sample sizes and fail to demonstrate significant impacts on clinically relevant outcomes. Consequently, current evidence does not justify recommending herbal medications in clinical practice. Furthermore, potential side effects, drug interactions

and contamination risks raise concerns. Physicians must enhance their understanding of herbal medications to effectively counsel patients on their potential benefits and risks, emphasizing that "natural" does not guarantee safety.

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