



# Journal of Modern Techniques in Biology and Allied Sciences

This Content Available at [www.lapinjournals.com](http://www.lapinjournals.com) ISSN (O): 3048-9970  
(An International online peer reviewed Journal)



Review Article

Open Access

## PHYTOCHEMICAL BASED STRATEGIES FOR CARDIOVASCULAR RISK REDUCTION: A NARRATIVE REVIEW

YERVA VYSHNAVI \*, SHAIK RESHMA, P.MOHAN VIKAS, CHANDU BABU RAO

Priyadarshini Institute of Pharmaceutical Education and Research, 5<sup>th</sup> Mile, Pulladigunta, Guntur-522017, Andhra Pradesh, India.

**\*CORRESPONDING AUTHOR**

Yerva Vyshnavi

**Article History:** Received: 19 Mar, 2026, Revised: 06 Apr, Accepted: 16 June, 2026

### ABSTRACT

The cardiovascular diseases (CVDs) continue to be a major cause of morbidity and mortality in most parts of the world, and there is need to research on complementary and alternative modes of treatment. Several medicinal plants have bioactive compounds of flavonoid, alkaloids, saponins and polyphenols which possess antioxidant, anti-inflammatory, antihypertensive, hypolipidemic, and antithrombotic properties. Some of the herbs, including *Allium sativum* (garlic), *Terminalia arjuna* (hawthorn), etc. have demonstrated potential effects on the cardiac system, blood pressure, serum cholesterol, and vascular conditions.

**Keywords:** Herbs, medicines, cardiovascular diseases, heart attack, potential benefits.

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### INTRODUCTION

Despite the progress in molecular medicine and in the diagnosis, prophylaxis and treatment, cardiovascular diseases (CVDs) remain the most common cause of death and disability worldwide. The global HM market was valued at \$151.91 billion in 2021 and is projected to grow to \$347.50 billion in 2029, at a compound annual growth rate of 11.3%. Herbs have been used medicinally for a very long time, and the practice is still common today. According to a recent survey, one in five Americans has used herbal or nutritional supplements at some time in their life. As per gauges, more than 25% of currently promoted medicines come from plants utilized in conventional medication [1]. CVD is a worldwide health issue that necessitates a global strategy for prevention. A safer, less expensive and more powerful substitute is necessary. The most significant therapeutic alternative for cardiovascular illness is medicinal plants. Herbal medicine has received considerable medical acceptance as a result of increased understanding of how herbs improve health. Growing evidence shows that consuming phytochemicals is an alternate and viable method for preventing CVD [2]. Naturally occurring compounds

have been proven in recent research to successfully prevent, regulate, or inhibit major variables such as oxidative stress and inflammatory agents. Numerous plant bioactive substances, such as carotenoids, tocotrienols, diosgenin, isoflavones, and flavonoids, have been linked to a reduction in the risk of CVD.

### I. HERBAL THERAPEUTICS FOR CARDIOVASCULAR DISEASES

This review will concentrate on the following cardiovascular diseases: hypertension, peripheral artery disease, heart failure, coronary artery disease, dyslipidemia, and thromboembolic disorders. Medicinal plants have been extensively explored for their potential role in the prevention and management of cardiovascular diseases (CVDs), which remain the leading cause of global mortality. Various phytochemicals, such as flavonoids, alkaloids, saponins, and polyphenols, present in plants like *Allium sativum* (garlic), *Curcuma longa* (turmeric), and *Panax ginseng* have demonstrated antioxidative, anti-inflammatory, and lipid-lowering properties that contribute to cardiovascular health [3]. HMs containing cardioactive compounds increase cardiac contractility and have

been used for the treatment of HF and cardiac arrhythmia. We, selected herbal medicines that might be effective in treating at least one of these ailments.

#### 1.1 Asian Ginseng

SCIENTIFIC NAME: Asian ginseng (*Panax ginseng*), BIOLOGICAL SOURCE: The dried rhizomes of *Panax ginseng* C.A Meyer, FAMILY: Araliaceae; ACTIVE CONSTITUENTS: Ginsenosides (Rb1, Rg1, Rc) Panaxosides, Polysaccharides, Flavonoids, PART USED: Root,

MEDICINAL USES: Cardioprotective effect, Improves myocardial function, Mild antihypertensive action, Enhances coronary blood flow, Reduces oxidative stress in heart tissue. Asian ginseng includes saponins termed ginsenosides that have a partial agonistic impact on steroidal receptors, according to preclinical findings from in vitro and in vivo investigations. By enhancing the release of nitric oxide (NO) from endothelial cells, altering calcium ion channels in myocardial cells, decreasing the formation of reactive oxygen species, and raising platelet adhesion, these saponins may have beneficial effects on the cardiovascular system.

#### 1.2 Astragalus

SCIENTIFIC NAME: *Astragalus membranaceus*, BIOLOGICAL SOURCE: Dried root of *Astragalus membranaceus*, FAMILY: Fabaceae, ACTIVE CONSTITUENTS: Astragalosides, flavonoids,

PART USED: Root, MEDICINAL USES: Protects myocardium from ischemic damage, improves cardiac function in heart failure, reduces oxidative stress in cardiovascular tissues, reduce hypertension, improves endothelial function, anti-inflammatory effect in atherosclerosis, anti-hyperlipidaemic effect. Astragalus is utilized as a safe framework for immune system stimulants and as an adjunctive treatment for upper respiratory problems and the normal common cold virus. This plant's anti-oxidant properties seem to be crucial in mediating this activity [4].

#### 1.3 Flaxseed Oil

SCIENTIFIC NAME: *Linum usitatissimum*, BIOLOGICAL SOURCE: Fixed oil obtained from the dried ripe seeds of *Linum usitatissimum*, FAMILY: Linaceae ACTIVE CONSTITUENTS: Alpha-linolenic acid Linoleic acid, Oleic acid, Tocopherols, PART USED: Seeds (oil extracted from seeds), MEDICINAL USES: Reduces serum triglycerides, helps lower blood pressure, anti-atherosclerotic, Improves endothelial function, anti-inflammatory effect, reduces risk of coronary heart disease, antiplatelet effect. Supplementation with flaxseed or its derivatives substantially reduced total and LDL cholesterol Triglycerides and high-density lipoprotein. (HDL) cholesterol were unaffected by flaxseed.

#### 1.4 Garlic

SCIENTIFIC NAME: *Allium sativum*, BIOLOGICAL SOURCE: Dried bulbs of *Allium sativum*, FAMILY: Amaryllidaceae, ACTIVE CONSTITUENTS: Allicin, Alliin Ajoene, Diallyl disulfide and other sulfur-

containing compounds, PART USED: Bulb, MEDICINAL USES: Reduces hypertension, lowers total cholesterol and LDL levels, anti-atherosclerotic, reduces risk of thrombosis, antioxidant cardioprotective effect, helps reduce risk of coronary artery disease. It has been shown to reduce blood pressure in hypertensive individuals, improve lipid profiles by decreasing low-density lipoprotein (LDL) cholesterol and increasing high-density lipoprotein (HDL) cholesterol, and inhibit platelet aggregation. These effects contribute to improved endothelial function and reduced progression of cardiovascular diseases [5].

#### 1.5 Ginkgo

SCIENTIFIC NAME: *Ginkgo biloba*, BIOLOGICAL SOURCE: Dried leaves of *Ginkgo biloba*, FAMILY: Ginkgoaceae, ACTIVE CONSTITUENTS: Ginkgolides (A,B,C), Bilobalide, Flavonoids, Terpene lactones, PART USED: Leaves, MEDICINAL USES: Improves peripheral and cerebral blood circulation, antiplatelet activity, Reduces risk of thrombosis, protects vascular endothelium, helps in intermittent claudication. It's potential role in treating cardiovascular diseases due to its vasodilatory, antioxidant, and anti-inflammatory properties. It has been shown to improve blood flow, reducing blood viscosity, and enhancing microcirculation. Multiple clinical studies have shown that ginkgo may help with symptoms in people with peripheral artery disease.

#### 1.6 Grape Seeds

SCIENTIFIC NAME: *Vitis vinifera*; BIOLOGICAL SOURCE: Dried ripe seeds of *Vitis vinifera*; FAMILY: Vitaceae; ACTIVE CONSTITUENTS: Oligomeric proanthocyanidins, Procyanidins, Catechins and epicatechins, Flavonoids, Phenolic acids; PART USED: Seeds; MEDICINAL USES: protects vascular endothelium, anti-atherosclerotic effect, improves endothelial function, reduces capillary fragility, helps chronic venous insufficiency.

Grape seeds might diminish platelet activity and platelet-dependent inflammatory responses [6]. GSE substantially decreased systolic blood pressure (SBP) while having no effect on diastolic blood pressure (DBP), blood lipid levels, or C reactive protein.

#### 1.7 Hawthorn

SCIENTIFIC NAME: *Crataegus monogyna* / *Crataegus laevigata*; BIOLOGICAL SOURCE: Dried leaves, flowers, and berries of *Crataegus* species; FAMILY: Rosaceae; ACTIVE CONSTITUENTS: Flavonoids, Oligomeric proanthocyanidins, triterpenicacids, Amines; PART USED: Leaves, flowers, berries; MEDICINAL USES: Improves coronary blood flow, increases force of heart contraction, anti-arrhythmic activity, reduces hypertension, anti-atherosclerotic.

Hawthorne may help in the management of heart failure by increasing cardiac output, reducing symptoms of angina, and lowering blood pressure. Early research

shows that combining hawthorn with digoxin may intensify the effects of the medication [7].

#### 1.8 MILK THISTLE

**SCIENTIFIC NAME:** *Silybum marianum*; **BIOLOGICAL SOURCE:** Dried ripe fruits (achenes) of *Silybum marianum*; **FAMILY:** Asteraceae; **ACTIVE CONSTITUENTS:** Silymarin complex, Flavonolignans, Flavonoids, Fixed oil; **PART USED:** Fruits (seeds); **MEDICINAL USES:** Reduces oxidative stress in cardiovascular tissues, Anti-atherosclerotic effect, improves endothelial function, anti-inflammatory action, cardioprotective effect in toxin-induced cardiac damage, lipid regulation in metabolic syndrome milk thistle has powerful anti-inflammatory and antioxidant capabilities. Silymarin was found to decisively diminish fasting glucose and HbA1c levels while affecting the blood lipid profile in a new meta examination enveloping five RCTs and 270 diabetic people [8].

#### 1.9. Turmeric

**SCIENTIFIC NAME:** *Curcuma longa*; **BIOLOGICAL SOURCE:** Dried rhizomes of *Curcuma longa*; **FAMILY:** Zingiberaceae; **ACTIVE CONSTITUENTS:** Curcuminoids, Volatile oils; **PART USED:** Rhizome; **MEDICINAL USES:** Reduces vascular inflammation, protects myocardium and blood vessels, reduces plaque formation, improves endothelial function, reduces thrombosis risk, cardioprotective in ischemic heart diseases. Turmeric, a commonly used spice, has garnered attention for its potential role in cardiovascular disease (CVD) management. Curcumin can suppress pro-inflammatory cytokines like TNF- $\alpha$  and IL-6, which play pivotal roles in atherogenesis [9].

#### 1.10. Reishi mushroom / Lingzhi

**SCIENTIFIC NAME:** *Ganoderma lucidum*; **BIOLOGICAL SOURCE:** Fruiting body of *Ganoderma lucidum* (Reishi mushroom); **FAMILY:** Ganodermataceae; **ACTIVE CONSTITUENTS:** Triterpenoids, Polysaccharides, Sterols, Proteins and peptides; **PART USED:** Fruiting body (dried mushroom); **MEDICINAL USES:** Reduces blood pressure, Lowers LDL cholesterol and triglycerides, Anti-atherosclerotic, improves circulation and endothelial function, reduces clot formation risk, cardioprotective effect

Due to oxidative stress caused by heavy metals and paraquats by blocking the mTOR/S6K signalling pathway and imposing dietary restrictions, respectively [10]. These peptides have the ability to inhibit ACE activity and are utilised in the treatment of hypertension.

#### 1.11. Jiaogulan

**SCIENTIFIC NAME:** *Gynostemma pentaphyllum*; **BIOLOGICAL SOURCE:** Aerial parts (leaves and stems) of *Gynostemma pentaphyllum*; **FAMILY:** Cucurbitaceae; **ACTIVE CONSTITUENTS:** Gypenosides (triterpenoid saponins), Flavonoids, Polysaccharides, Sterols; **PART USED:** Leaves and stems; **MEDICINAL USES:** Reduces blood pressure, Lowers serum cholesterol and triglycerides, prevents

plaque formation, improves endothelial function and circulation, protects heart and vascular tissue

It shows synergistic effects by raising oxidation and decreasing lipid synthesis. Additionally, it exhibits protection against the development of foam cells and intracellular lipid accumulation brought on by oxidised low-density lipoprotein. Finally, it regulates cholesterol metabolism [11]

#### 1.12. Black cumin

**SCIENTIFIC NAME:** *Nigella sativa*; **BIOLOGICAL SOURCE:** Seeds of *Nigella sativa*; **FAMILY:** Ranunculaceae; **ACTIVE CONSTITUENTS:** Thymoquinone, nigellone, alpha-hederin, fixed oils, alkaloids and saponins; **PART USED:** Seeds; **MEDICINAL USES:** Antihypertensive effect, Lowers total cholesterol, LDL, and triglycerides, Anti-atherosclerotic, protects myocardium and vascular endothelium, reduces risk of thrombosis. The seeds of the plant are also high in antioxidants, which support the scavenging of harmful free radicals and the protection of cells from oxidative damage [12].

#### 1.13. Drumstick tree

**SCIENTIFIC NAME:** *Moringa oleifera*; **BIOLOGICAL SOURCE:** Leaves, seeds, and pods of *Moringa oleifera*; **FAMILY:** Moringaceae; **ACTIVE CONSTITUENTS:** Flavonoids, phenolic acids, glucosinolates, vitamins (A,C,E) and minerals, alkaloids and saponins; **PART USED:** Leaves, seeds, pods; **MEDICINAL USES:** Antihypertensive effect, lowers serum cholesterol, triglycerides, and LDL, protects heart and blood vessels, prevents plaque formation, improves endothelial function and circulation. *Moringa oleifera* inhibits apoptosis, enhances cardiac contractility, and protects the structural integrity of the heart. It exhibits antioxidant and anti-inflammatory properties that are effective for hyperglycaemia, hypertension, dyslipidaemia, and obesity [13].

#### 1.14. Utazi /Arokeke

**SCIENTIFIC NAME:** *Gongronema latifolium*; **BIOLOGICAL SOURCE:** Leaves of *Gongronema latifolium*; **FAMILY:** Apocynaceae; **ACTIVE CONSTITUENTS:** Saponins, flavonoids, alkaloids, tannins, glycosoids; **PART USED:** Leaves; **MEDICINAL USES:** Antihypertensive effect, anti-hyperlipidemic, Antioxidant, Anti-atherosclerotic. The hypotensive activities of *G. latifolium* are facilitated by the synergistic action of the substances, most likely via the -adrenergic blocking pathway.

#### 1.15. Yellow Gentiana

**SCIENTIFIC NAME:** *Gentiana lutea*; **BIOLOGICAL SOURCE:** Dried roots of *Gentiana lutea*; **FAMILY:** Gentianaceae; **ACTIVE CONSTITUENTS:** Secoiridoid glycosides, bitter principles, xanthenes, flavonoids; **PART USED:** Root; **MEDICINAL USES:** Helps reduce blood pressure, improves circulation and peripheral blood flow, supports heart function indirectly by enhancing digestion and nutrient absorption, protect vascular endothelium. It works through many

mechanisms of blood pressure reduction caused by preventing Ca<sup>2+</sup> entry and release from intracellular storage, it also prevents the buildup of plaque in the artery and cures by preventing the proliferation of vascular smooth muscle cells [14].

#### 1.16. Silver Cockscomb

**SCIENTIFIC NAME:** *Celosia argentea*; **BIOLOGICAL SOURCE:** Leaves and seeds of *Celosia argentea*; **FAMILY:** Amaranthaceae; **ACTIVE CONSTITUENTS:** Flavonoids, saponins, alkaloids, phenolic compounds, tannins; **PART USED:** Leaves and seeds; **MEDICINAL USES:** Antihypertensive, Anti-hyperlipidemic, protects vascular endothelium, Anti-atherosclerotic. Its vasodilatory response is mostly due to its role in the nitric oxide/cGMP and prostaglandin/cAMP pathways. Its actions are associated with the activation of voltage-dependent K<sup>+</sup> channels [15].

#### 1.17. Bergamot orange

**SCIENTIFIC NAME:** *Citrus bergamia*; **BIOLOGICAL SOURCE:** It is obtained from the peel (rind) of the fruit of *Citrus bergamia* Risso and Poiteau; **FAMILY:** *Rutaceae*; **ACTIVE CONSTITUENTS:** Flavonoids Essential oils, Coumarins, Polyphenols; **PART USED:** Peel, fruit, essential oil; **MEDICINAL USES:** Reduces total cholesterol and LDL levels, Increases HDL cholesterol, protects vascular endothelium, prevents plaque formation, mild antihypertensive effect. Its antioxidants such as flavonoids (naringin, neohesperidin, rutin) that help the body scavenge free radicals, which damages blood vessels and has been demonstrated to improve levels of lipids by reducing LDL cholesterol, and triglycerides [16].

#### 1.18. Olive tree

**SCIENTIFIC NAME:** *Olea europaea*  
**BIOLOGICAL SOURCE:** Leaves and fruit of *Olea europaea* (olive tree); **FAMILY:** *Oleaceae* **ACTIVE CONSTITUENTS:** Oleuropein, Hydroxytyrosol, Flavonoids, Triterpenes, acids Phenolic, Monounsaturated fatty acids ; **PART USED:** Leaves, fruit, and oil extracted from fruit; **MEDICINAL USES:** Reduces blood pressure, lowers LDL cholesterol and triglycerides; increases HDL, protects vascular endothelium and myocardium, anti-atherosclerotic, improves endothelial function, anti-inflammatory effect. *Olea europaea* (olive) exerts protective effects by its compounds which enhance nitric oxide bioavailability, inhibit LDL oxidation, and suppress inflammatory pathways, leading to reduced atherosclerotic plaque formation [17].

#### 1.19. Bilberry

**SCIENTIFIC NAME:** *Vaccinium myrtillus*; **BIOLOGICAL SOURCE:** Dried ripe berries of *Vaccinium myrtillus*; **FAMILY:** *Ericaceae*; **ACTIVE CONSTITUENTS:** Anthocyanins, Flavonoids Tannins, Phenolic acids; **PART USED:** Berries; **MEDICINAL USES:** Protects blood vessels and heart tissue, Strengthens capillaries and improves microcirculation, reduces LDL oxidation, Mild antihypertensive effect, improves endothelial

function. Bilberry (*Vaccinium myrtillus*) compounds enhance nitric oxide-mediated vasodilation and regulate vascular signaling pathways. Bilberry intake has been linked to reduced circulating microvesicles and modulation of endothelial vesiculation pathways [18-19].

## 2. DRUG SAFETY

Few randomized clinical trials (RCTs) have methodically assessed the safety profile of many widely used HMs and information rely mainly on spontaneous reporting, case reports, small clinical trials and passive post-marketing surveillance [20-21]. Physicians may not associate new signs/symptoms with the use of HMs as often as they do with those associated with prescribed medications, and manufacturers rarely report the AEs. It is necessary to educate and encourage patients to report AEs, improve and standardize the pharmacovigilance for HMs because their use is highly prevalent and safety concerns associated with their use continue to emerge [22].

## 3. OTHER PROBLEMS RELATED TO THE USE OF HERBAL PRODUCTS

There are other challenges associated with the use of HMs, which is discussed below.

1. Lack of scientific evidence of their clinical efficacy and safety [23].
2. Lack of standardization.
3. Lack of quality control
4. Scientific misinformation [24].

## 4. SIDE EFFECTS OF HERBAL PRODUCTS IN CARDIOVASCULAR DISEASES

Bleeding risks, hypertension, drug interactions, gastrointestinal issues, liver toxicity [25].

## 5. FUTURE DIRECTIONS AND FUTURE SCOPE OF HERBAL PRODUCTS

Conducting high-quality RCTs, Standardization of herbal products, investigating mechanisms of action, Addressing herb-drug interactions, Patient education and informed consent [26-27].

## 6. LIMITATIONS OF HERBAL PRODUCTS IN CARDIOVASCULAR DISEASES

Variability in plant species, cultivation, harvesting, and processing leads to inconsistent composition, unpredictable potency, and unclear dosage recommendations, while inadequate standardization and regulatory oversight increase the risk of contamination or adulteration [28]. Therefore, despite their therapeutic potential, careful regulation, rigorous clinical evaluation, and medical supervision are essential for their safe integration into cardiovascular care (Frontiers in Pharmacology, 2023; Phytomedicine, 2024) [29-30].

## 7. CONCLUSION

Herbal products and plant-derived compounds continue to attract interest for cardiovascular disease (CVD) management due to their antioxidant, anti-inflammatory, antihypertensive, lipid-modulating, and antithrombotic properties observed in numerous preclinical studies and some clinical settings, suggesting potential population-level benefits of certain herbal combinations. Despite these promising findings, robust evidence confirming clinically meaningful effects on major cardiovascular outcomes remains limited, and safety. Future research must prioritize large, well-designed randomized controlled trials with standardized products to clarify efficacy, safety, and mechanisms of action before widespread clinical adoption.

## 8. AUTHOR CONTRIBUTIONS

All authors are contributed equally

## 9. FINANCIAL SUPPORT

None

## 10. DECLARATION COMPETING INTEREST

The authors have no conflicts of interest to declare.

## 11. ACKNOWLEDGEMENTS

None

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