



Traditional herbs: a remedy for cardiovascular disorders



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ABSTRACT

Background: Medicinal plants have been used in patients with congestive heart failure, systolic hypertension, angina pectoris, atherosclerosis, cerebral insufficiency, venous insufficiency and arrhythmia since centuries. A recent increase in the popularity of alternative medicine and natural products has revived interest in traditional remedies that have been used for the treatment of cardiovascular diseases.

Aim: The purpose of this review is to provide updated, comprehensive and categorized information on the history and traditional uses of some herbal medicines that affect the cardiovascular system in order to explore their therapeutic potential and evaluate future research opportunities.

Methods: Systematic literature searches were carried out and the available information on various medicinal plants traditionally used for cardiovascular disorders was collected via electronic search (using Pubmed, SciFinder, Scirus, GoogleScholar, JCCC@INSTIRC and Web of Science) and a library search for articles published in peer-reviewed journals. No restrictions regarding the language of publication were imposed.

Results: This article highlights the cardiovascular effects of four potent traditional botanicals viz. Garlic (*Allium sativum*), Guggul (*Commiphora wightii*), Hawthorn (*Crataegus oxyacantha*) and Arjuna (*Terminalia arjuna*). Although these plants have been used in the treatment of heart disease for hundreds of years, current research methods show us they can be utilized effectively in the treatment of cardiovascular diseases including ischemic heart disease, congestive heart failure, arrhythmias and hypertension.

Conclusion: Although the mechanisms of action are not very clear, there is enough evidence of their efficacy in various cardiovascular disorders. However, for bringing more objectivity and also to confirm traditional claims, more systematic, well-designed animal and randomized clinical studies with sufficient sample sizes are necessary. Multidisciplinary research is still required to exploit the vast potential of these plants. Potential synergistic and adverse side effects of herb–drug interactions also need to be studied. These approaches will help in establishing them as remedies for cardiovascular diseases and including them in the mainstream of healthcare system.

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Introduction

Cardiovascular diseases (CVDs) are caused by disorders of the heart and blood vessels, and include coronary heart disease (heart attacks), cerebrovascular disease (stroke), raised blood

Abbreviations: AIIMS, All India Institute of Medical Sciences; BAR, bile acid receptor; BNP, brain natriuretic peptide; CAD, coronary artery disease; CAZRI, Central Arid Zone Research Institute; CCRAS, Central Council for Research in Ayurveda & Siddha; CDRI, Central Drug Research Institute; CHF, congestive heart failure; CIMAP, Central Institute of Medicinal and Aromatic Plants; CVDs, cardiovascular diseases; CYP7A1, cholesterol 7- α -hydroxylase/cytochrome P450 7A1; FXR, farnesoid X receptor; HDL, high density lipoprotein; KCCQ, Kansas City Cardiomyopathy Questionnaire; LDL, low density lipoprotein; NMPB, National Medicinal Plants Board; NYHA, New York Heart Association; OPC, oligomeric procyanidins; PGE2, prostaglandin E2; PXR, pregnane X receptor; STZ, streptozotocin.

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pressure (hypertension), peripheral artery disease, rheumatic heart disease, congenital heart disease and heart failure (http://www.who.int/topics/cardiovascular_diseases/en/). Globally, more people die from CVDs than from any other cause annually. An estimated 17.5 million people died from CVDs in 2012, representing 31% of all global deaths. Of these deaths, an estimated 7.4 million were due to coronary heart disease and 6.7 million were due to stroke. The cause of heart attacks and strokes are usually the presence of a combination of risk factors, such as tobacco use, unhealthy diet and obesity, physical inactivity and harmful use of alcohol, hypertension, diabetes and hyperlipidaemia. Over three quarters of CVD deaths take place in low- and middle-income countries (<http://www.who.int/mediacentre/factsheets/fs317/en/>).

Herbs have been an integral part of society since the beginning of human civilization. They have been used both because of their culinary as well as medicinal properties. Herbal medicine has made many contributions to commercial drug preparations manufactured today including ephedrine from *Ephedra sinica*, digitoxin from *Digitalis*

purpurea, salicin (the source of aspirin) from *Salix alba* and reserpine from *Rauwolfia serpentina*. A naturally occurring β -adrenergic blocking agent with partial agonism has been identified in a herbal remedy (Wu et al. 1998). The recent discovery of the antineoplastic drug paclitaxel from *Taxus brevifolia* (pacific yew tree) stresses the role of plants as a continuing resource for modern medicine.

Medicinal plants have been used in patients with congestive heart failure, systolic hypertension, angina pectoris, atherosclerosis, cerebral insufficiency, venous insufficiency, and arrhythmia. Although most herbal medicines have multiple cardiovascular effects that frequently overlap, they can be categorized under the primary conditions they treat (Mashour et al. 1998). A number of herbs contain potent cardioactive glycosides, which have positive inotropic actions on the heart. The drug digitoxin, derived from either *D. purpurea* (foxglove) or *D. lanata*, and digoxin, derived from *D. lanata* alone, has been used in the treatment of congestive heart failure (CHF) for many decades. Some common plant sources of cardiac glycosides include *D. purpurea* (foxglove), *Adonis microcarpa* and *Adonis vernalis* (adonis), *Apocynum cannabinum* (black Indian hemp), *Asclepias curassavica* (redheaded cotton bush), *Asclepias fruticosa* (balloon cotton), *Calotropis procera* (king's crown), *Carissa spectabilis* (wintersweet), *Cerebera manghas* (sea mango), *Cheiranthus cheiri* (wallflower), *Convallaria majalis* (lily of the valley, convallaria), *Cryptostegia grandiflora* (rubber vine), *Helleborus niger* (black hellebore), *Helleborus viridis*, *Nerium oleander* (oleander), *Plumeria rubra* (frangipani), *Selenicereus grandiflorus* (cactus grandiflorus), *Strophanthus hispidus* and *Strophanthus kombe* (strophanus), *Thevetia peruviana* (yellow oleander), and *Urginea maritima* (squill). However, accidental poisonings and even suicide attempts with ingestion of cardiac glycosides are abundant in the medical literature. The root of *Rauwolfia serpentina* (snakeroot), the natural source of the alkaloid reserpine, has been a Hindu Ayurvedic remedy since ancient times. In 1931, Indian literature first described the use of *R. serpentina* root for the treatment of hypertension and psychoses. *Stephania tetrandra* is a herb sometimes used in traditional Chinese medicine to treat hypertension. Tetrandrine, an alkaloid extract of *S. tetrandra*, has been shown to be a calcium ion channel antagonist, paralleling the effects of verapamil. Tetrandrine blocks T and L calcium channels, interferes with the binding of diltiazem and methoxyverapamil at calcium-channel binding sites, and suppresses aldosterone production. The root of *Lingusticum wallichii* is used in traditional Chinese medicine as a circulatory stimulant, hypotensive drug, and sedative. Tetramethylpyrazine is the active constituent extracted from *L. wallichii*. *Uncaria rhynchophylla* is sometimes used in traditional Chinese medicine to treat hypertension. Its indole alkaloids, rhynchophylline and hirsutine, are thought to be the active principles responsible for *U. rhynchophylla*'s vasodilatory effect. *Evodia rutaecarpa* (wu-chu-yu) is a Chinese herbal drug that has been used as a treatment for hypertension. It contains an active vasorelaxant component called rutaecarpine that can cause endothelium-dependent vasodilation in experimental models. *Crataegus hawthorn*, a name encompassing many *Crataegus* species (such as *Crataegus oxyacantha* and *Crataegus monogyna* in the West and *Crataegus pinnatifida* in China), has acquired the reputation in modern herbal literature as an important tonic for the cardiovascular system that is particularly useful for angina. From current studies, *Crataegus* extract appears to have antioxidant properties and can inhibit the formation of thromboxane as well. In traditional Chinese medicine, the root of *Panax notoginseng* is used for analgesia and haemostasis. It is also often used in the treatment of patients with angina and coronary artery disease (CAD). In traditional Chinese medicine, the root of *Salvia miltiorrhiza* is used as a circulatory stimulant, sedative, and cooling drug. *S. miltiorrhiza* may be useful as an antianginal drug because it has been shown to dilate coronary arteries in all concentrations, similar to *P. notoginseng*.

The powdered tree bark of *Terminalia arjuna* has been mentioned to be useful for "hritshool" (angina) and other related cardiac ail-

ments by the ancient Indian physicians. Recently there has been renewed interest in this plant because of its multimode cardioprotective activity. In addition to its use in the culinary arts, garlic (*Allium sativum*) has been valued for centuries for its medicinal properties. Garlic is one of the herbal medicines that have been examined more closely by the scientific community. In recent decades, research has focused on garlic's use in preventing atherosclerosis. The resin of *Commiphora wightii* or *Commiphora mukul* (gugulipid), a small, thorny tree native to India, has long been used in Ayurvedic medicine to treat lipid disorders.

Some herbs that are commonly used for cardiovascular disorders in different parts of the world have been listed in Table 1.

A recent increase in the popularity of alternative medicine and natural products has revived interest in traditional remedies that have been used for the treatment of CVDs through centuries. This review examines four such herbal medicines viz. Garlic (*A. sativum*), Guggul (*C. wightii*), Hawthorn (*C. oxyacantha*) and Arjuna (*T. arjuna*) that affect the cardiovascular system both in terms of efficacy and safety as evidenced from the scientific literature that is available. This review may be useful in increasing our knowledge of their history as well as their therapeutic effects and in improving our future experimental and clinical research plans.

Methods

Systematic literature searches were carried out and the available information on various medicinal plants traditionally used for cardiovascular disorders was collected via electronic search (using Pubmed, SciFinder, Scirus, GoogleScholar, JCCC@INSTIRC and Web of Science) and a library search for articles published in peer-reviewed journals. No restrictions regarding the language of publication were imposed.

Results and discussion

Allium sativum L

Plant description and distribution

Garlic, *A. sativum* L. is a member of the Alliaceae family. It is a bulbous plant; grows up to 1.2 m in height. Cultivated practically throughout the world, garlic appears to have originated in central Asia and then spread to China, the Near East and the Mediterranean region before moving west to Central and Southern Europe, Northern Africa (Egypt) and Mexico (Singh and Singh 2008).

History of use

It is used universally as a flavouring agent as well as traditional medicine. Garlic has been used for thousands of years for medicinal purposes. Sanskrit records show its medicinal use about 5000 years ago, and it has been used for at least 3000 years in Chinese medicine. The Egyptians, Babylonians, Greeks, and Romans used garlic for healing purposes. It has long been used both for flavouring and for the potential benefits of preventing and curing ailments in many cultures (Londhe et al. 2011). The beneficial effects of garlic consumption in treating a wide variety of human diseases and disorders have been known for centuries; thus, garlic has acquired a special position in the folklore of many cultures as a formidable prophylactic and therapeutic medicinal agent. It is even cited in the Egyptian Codex Ebers, a 3500-year-old document, as useful in the treatment of heart disorders, tumours, worms, bites, and other ailments (Rahman 2001).

Some of the earliest references to this medicinal plant were found in Avesta, a collection of Zoroastrian holy writings that was probably compiled during the sixth century BC (Dannesteter 2003). Garlic has also played as an important medicine to Sumerian and the

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