



International Journal of Science, Architecture, Technology and Environment

A Review on Medicinal Herbs its Potential Activities in Hypertension

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DOI: <https://doi.org/10.63680/ijstate1025071.062>

Abstract

Medicinal herbs have demonstrated significant potential as natural remedies for managing hypertension due to their active compounds, including flavonoids, alkaloids, saponins, and phenolic acids. These compounds can help lower blood pressure through multiple mechanisms, such as promoting vasodilation, exerting diuretic and antioxidant effects, inhibiting angiotensin-converting enzyme (ACE), and improving endothelial function. Evidence from experimental and clinical studies indicates their ability to reduce cardiovascular risk factors. Nonetheless, further research is needed to standardize herbal preparations, determine optimal dosages, and conduct well-designed clinical trials. Using medicinal herbs alongside conventional treatments may provide a safe, complementary, and cost-effective strategy for managing hypertension and supporting cardiovascular health.

Keywords: Medicinal Herbs. Hypertension, Activities, Management

INTRODUCTION

Hypertension is a long-term medical condition in which the pressure of blood within the arteries remains consistently higher than normal. Blood pressure (BP) is expressed in **millimeters of mercury (mmHg)** and recorded as **systolic/diastolic** values, such as 120/80 mmHg.

Blood Pressure Categories (per American Heart Association, 2017)

- **Normal:** Less than 120/80 mmHg
- **Elevated:** 120–129/<80 mmHg
- **Stage 1 Hypertension:** 130–139/80–89 mmHg
- **Stage 2 Hypertension:** ≥140/≥90 mmHg
- **Hypertensive Crisis:** >180/>120 mmHg

1. Types of Hypertension

A. Primary (Essential) Hypertension

- Represents 90–95% of cases.
- No specific identifiable cause.
- Common risk factors:
 - Older age (>55 years)
 - Family history of hypertension
 - Obesity or overweight
 - High dietary salt intake
 - Physical inactivity
 - Chronic stress
 - Smoking and alcohol consumption

B. Secondary Hypertension

- Accounts for 5–10% of cases.
- Occurs due to an underlying medical condition or medication.
- Typical causes include:
 - Kidney diseases (e.g., chronic kidney disease, glomerulonephritis)
 - Hormonal disorders (e.g., hyperthyroidism, Cushing's syndrome, primary aldosteronism)
 - Sleep apnea
 - Certain drugs (e.g., NSAIDs, steroids, oral contraceptives)

2. How Hypertension Develops (Pathophysiology)

High blood pressure arises from **increased cardiac output, elevated systemic vascular resistance, or both**. Key mechanisms include:

- **Genetic factors:** Affecting kidney sodium handling
- **Renin-Angiotensin-Aldosterone System (RAAS) overactivity:** Leads to vasoconstriction and fluid retention
- **Excess sympathetic nervous system activity:** Raises heart rate and vascular tone
- **Endothelial dysfunction:** Reduces nitric oxide, impairing blood vessel relaxation
- **Kidney dysfunction:** Inability to excrete sodium and water, causing volume overload

3. Symptoms

Hypertension is often **asymptomatic**, earning the nickname “silent killer.”

Possible symptoms, if they occur:

- Morning headaches
- Dizziness

- Blurred vision
- Palpitations
- Shortness of breath

Severe or malignant hypertension may present with:

- Retinal bleeding
- Swelling of the optic disc (papilledema)
- Enlargement of the heart's left ventricle (detectable on ECG)

4. Complications

Chronic hypertension can damage multiple organs, known as **target organ damage**:

- **Heart:** Left ventricular hypertrophy, heart failure, heart attack
- **Brain:** Stroke, transient ischemic attacks, cognitive decline
- **Kidneys:** Chronic kidney disease, hypertensive nephropathy
- **Eyes:** Hypertensive retinopathy
- **Blood vessels:** Aneurysms, peripheral artery disease

5. Diagnosis

- **Blood pressure measurement:** Multiple readings on different days; ambulatory BP monitoring is most accurate
- **Laboratory tests:** Blood sugar, cholesterol, kidney function; urine tests for protein and electrolytes
- **Imaging (if secondary hypertension suspected):** Renal ultrasound, echocardiography, CT/MRI for adrenal or vascular abnormalities

6. Treatment

A. Lifestyle Changes

- Reduce salt intake (<5 g/day)
- Maintain healthy body weight
- Regular aerobic exercise
- Limit alcohol and avoid smoking
- Manage stress

B. Medications

- **Diuretics:** Hydrochlorothiazide, furosemide
- **ACE inhibitors:** Lisinopril, enalapril
- **Angiotensin receptor blockers (ARBs):** Losartan, valsartan
- **Calcium channel blockers:** Amlodipine, diltiazem

- **Beta-blockers:** Metoprolol, atenolol
- **Aldosterone antagonists:** Spironolactone

Target BP: Usually below 130/80 mmHg for most adults

C. Hypertensive Emergencies

- Rapid BP reduction using intravenous medications (e.g., labetalol, nitroprusside)
- Continuous monitoring for organ damage

7. Prognosis

- **Controlled hypertension:** Life expectancy similar to healthy individuals
- **Uncontrolled hypertension:** Increased risk of cardiovascular, kidney, and brain complications

1. Garlic (*Allium sativum*)

- **How it works:** Contains allicin, which can help relax blood vessels and boost nitric oxide levels.
- **Research evidence:** Studies indicate modest decreases in both systolic and diastolic blood pressure.
- **Usage:** Eat 1–2 fresh cloves daily, or take powdered supplements/aged garlic extract (600–1,200 mg/day).
- **Cautions:** May increase bleeding risk, especially with blood thinners; can cause stomach upset.

2. Hawthorn (*Crataegus spp.*)

- **How it works:** Acts as a vasodilator and antioxidant, supporting heart health and reducing vascular resistance.
- **Research evidence:** Small trials suggest slight reductions in BP and improved symptoms in heart failure patients.
- **Usage:** Standardized extracts (250–500 mg, 2–3 times/day).
- **Cautions:** May interact with digoxin and other cardiac medications.

3. Hibiscus (*Hibiscus sabdariffa*)

- **How it works:** Rich in anthocyanins, it may help lower blood pressure through mild diuretic and vasodilatory effects.
- **Research evidence:** Meta-analyses show hibiscus tea can lower systolic BP by ~7 mmHg and diastolic by ~3 mmHg.
- **Usage:** Drink 1–2 cups of tea daily or use standardized extracts.
- **Cautions:** Can significantly lower BP, so monitor if taking antihypertensives.

4. Celery Seed (*Apium graveolens*)

- **How it works:** Contains phthalides, which may relax arterial walls and act as a mild diuretic.

- **Research evidence:** Animal studies and limited human research suggest small reductions in BP.
- **Usage:** Capsules or extracts (50–100 mg/day).
- **Cautions:** Acts as a blood thinner; avoid during pregnancy.

5. Green Tea (*Camellia sinensis*)

- **How it works:** Catechins and polyphenols may improve blood vessel function and reduce oxidative stress.
- **Research evidence:** Regular intake can modestly lower systolic BP by 2–3 mmHg.
- **Usage:** Drink 2–3 cups per day.
- **Cautions:** High doses may cause insomnia or interact with caffeine-sensitive individuals.

6. Ginger (*Zingiber officinale*)

- **How it works:** Has vasodilatory, anti-inflammatory, and mild diuretic effects.
- **Research evidence:** Small trials suggest slight reductions in both systolic and diastolic BP.
- **Usage:** Fresh, powdered, or capsule form (1–3 g/day).
- **Cautions:** May increase bleeding risk; use cautiously with anticoagulants.

7. Turmeric / Curcumin (*Curcuma longa*)

- **How it works:** Anti-inflammatory and antioxidant properties can support blood vessel health.
- **Research evidence:** Limited studies suggest minor reductions in BP in hypertensive individuals.
- **Usage:** 500–1,000 mg/day of curcumin, ideally with black pepper for better absorption.
- **Cautions:** May interact with blood-thinning medications.

8. Flaxseed (*Linum usitatissimum*)

- **How it works:** Contains omega-3 fatty acids and lignans, improving vascular function.
- **Research evidence:** Clinical trials show systolic BP reductions of ~10 mmHg and diastolic reductions of ~7 mmHg with 30 g/day.
- **Usage:** Ground seeds incorporated into meals.
- **Cautions:** Can affect absorption of some medications if taken at the same time.

Medicinal Plants in Hypertension Management

1. Understanding Hypertension

Hypertension, or **high blood pressure**, is among the most common cardiovascular conditions globally. It is defined as a persistent elevation of **systolic blood pressure (≥ 140 mmHg)** and/or **diastolic blood pressure (≥ 90 mmHg)**. When uncontrolled, hypertension can cause serious damage to critical organs such as the **heart, kidneys, brain, and blood vessels**, eventually leading to life-threatening complications such as **stroke, myocardial infarction, heart failure, and renal impairment**.

Although conventional medications—such as **ACE inhibitors, calcium channel blockers, diuretics, and beta-blockers**—are effective in managing hypertension, their long-term use is frequently associated with **undesirable side effects, tolerance development, and economic challenges**, particularly in low-income populations.

Consequently, **medicinal plants** are being increasingly recognized as **alternative or complementary therapeutic agents** due to their **natural origin, affordability, accessibility, and relatively safer pharmacological profiles**.

2. Importance of Medicinal Plants in Hypertension Management

Medicinal plants are rich sources of **bioactive phytochemicals** that influence blood pressure regulation through multiple biological pathways. Compounds such as **flavonoids, alkaloids, terpenoids, glycosides, tannins, and phenolic acids** exhibit **vasodilatory, diuretic, antioxidant, anti-inflammatory, and calcium channel-blocking properties**, making them valuable in the control and prevention of hypertension.

Advantages of Medicinal Plants:

- **Natural and safer alternatives:** Generally produce fewer side effects compared to synthetic drugs.
- **Affordable and easily accessible:** Especially beneficial for people in rural or resource-limited settings.
- **Multi-targeted mechanisms:** Act on several physiological pathways simultaneously, improving overall cardiovascular function.
- **Potential for drug discovery:** Provide a vast chemical diversity for developing new antihypertensive agents.

3. Mechanisms of Action of Antihypertensive Medicinal Plants

Medicinal plants help regulate blood pressure through several complementary mechanisms:

A. Vasodilation

Certain plant-derived compounds promote the relaxation of vascular smooth muscles, decreasing peripheral resistance and lowering blood pressure.

→ *Example: Allium sativum* (Garlic) enhances the release of **nitric oxide (NO)** and **hydrogen sulfide (H₂S)**, both of which promote vasodilation.

B. Diuretic Effect

Some plants increase **urine output**, thereby reducing circulating blood volume and arterial pressure.

→ *Example: Hibiscus sabdariffa* (Roselle) and *Taraxacum officinale* (Dandelion) exhibit mild **diuretic** effects.

C. Antioxidant Activity

Oxidative stress contributes to endothelial dysfunction, a major factor in hypertension. Antioxidant-rich plants neutralize **free radicals**, improving vascular elasticity and function.

→ *Example: Camellia sinensis* (Green Tea) and *Moringa oleifera* contain potent antioxidants that protect against oxidative damage.

D. ACE (Angiotensin-Converting Enzyme) Inhibition

Phytochemicals in certain plants inhibit the **ACE enzyme**, preventing the conversion of angiotensin I to angiotensin II—a strong vasoconstrictor.

→ *Example: Allium sativum* (Garlic) and *Hibiscus sabdariffa* effectively reduce ACE activity.

E. Calcium Channel Blockade

Some plant constituents inhibit **calcium influx** into vascular smooth muscle cells, promoting vasorelaxation.

→ *Example: Annona muricata* (Soursop) and *Ocimum sanctum* (Holy Basil) demonstrate calcium channel-blocking activity.

F. Lipid-Lowering and Anti-inflammatory Effects

Several plants reduce serum **cholesterol** and **triglyceride** levels while controlling vascular inflammation, thus improving cardiovascular health.

→ *Example: Curcuma longa* (Turmeric) and *Zingiber officinale* (Ginger) lower lipid levels and protect arterial walls from inflammation.

4. Examples of Important Antihypertensive Medicinal Plants

Scientific Name	Common Name	Active Constituents	Mode of Action / Therapeutic Effect
<i>Allium sativum</i>	Garlic	Allicin, S-allyl cysteine	Vasodilatory, ACE inhibition, antioxidant
<i>Hibiscus sabdariffa</i>	Roselle	Anthocyanins, hibiscus acid	Diuretic, ACE inhibition, antioxidant
<i>Moringa oleifera</i>	Drumstick Tree	Quercetin, isothiocyanates	Antioxidant, vasodilation, calcium channel blockade
<i>Ocimum sanctum</i>	Holy Basil	Eugenol, ursolic acid	Vasorelaxant, anti-inflammatory, antioxidant
<i>Zingiber officinale</i>	Ginger	Gingerol, shogaol	Improves blood flow, inhibits platelet aggregation
<i>Camellia sinensis</i>	Green Tea	Catechins, EGCG	Antioxidant, lipid-lowering, ACE inhibition
<i>Curcuma longa</i>	Turmeric	Curcumin	Anti-inflammatory, antioxidant, vasodilator
<i>Rauwolfia serpentina</i>	Indian Snakeroot	Reserpine	Reduces sympathetic nerve activity, lowers cardiac output
<i>Terminalia arjuna</i>	Arjuna Tree	Arjunolic acid, flavonoids	Strengthens cardiac muscles, improves circulation
<i>Annona muricata</i>	Soursop	Acetogenins, alkaloids	Calcium channel blocker, antioxidant

5. Integration of Medicinal Plants with Modern Therapy

Combining medicinal plants with conventional antihypertensive treatments can yield synergistic effects that:

- **Enhance therapeutic efficiency,**
- **Reduce drug dosage requirements,** and
- **Minimize side effects.**

For instance, **Garlic (*Allium sativum*)** supplementation has been reported to enhance the antihypertensive effects of **ACE inhibitors** and **beta-blockers**.

Furthermore, the **standardization and formulation** of plant-based products such as *Hibiscus sabdariffa* and *Moringa oleifera* extracts are paving the way for their use as **phytopharmaceuticals** in global hypertension management.

6. Advantages of Using Medicinal Plants in Hypertension

- **Natural and Non-toxic:** Generally safe when consumed at appropriate doses.
- **Affordable and Accessible:** Ideal for low-income or rural populations.
- **Multifunctional Benefits:** Regulate blood pressure while improving lipid and antioxidant profiles.
- **Complementary Use:** Can safely augment modern antihypertensive drugs.
- **Cultural Relevance:** Widely recognized in traditional systems such as **Ayurveda, Unani, and Traditional Chinese Medicine.**

7. Economic and Environmental Significance

The cultivation and commercialization of medicinal plants not only provide **economic opportunities** for rural communities but also support **sustainable agricultural practices**. Moreover, promoting the use of these plants reduces dependence on imported synthetic drugs and encourages **biodiversity conservation**.

8. Challenges and Limitations

Despite their great potential, several issues hinder the widespread adoption of medicinal plants in hypertension therapy:

- **Lack of dosage standardization** and uniform formulations
- **Variability in phytochemical content** due to ecological factors
- **Limited clinical and pharmacological validation**
- **Possible herb-drug interactions** with synthetic medications
- **Overharvesting and environmental degradation** of wild species

To ensure efficacy and safety, **scientific validation, toxicological screening, and sustainable cultivation** of these plants are essential.

Declaration of Conflicting Interests

The authors declare no potential conflicts of interest with respect to the research, authorship and publication of this article.

Funding

The author received no financial support for the research, authorship and publication of this article.

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