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[Matthew Halma](#) \* and Yusuf Saleeby

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Review

# Herbal Medicine for Hypertension: A Review of Potential Therapeutics

Matthew Halma <sup>1,\*</sup> and Yusuf Saleeby <sup>2</sup>

<sup>1</sup> EbMC Squared CIC, 11 Laura Place, Bath, UK, BA2 4BL

<sup>2</sup> Carolina Holistic Medicine, Mount Pleasant, SC, USA

\* Correspondence: m.t.j.halma@vu.nl

**Abstract:** Hypertension is a global public health challenge, with a high prevalence across various regions and significant implications for cardiovascular risk. This article reviews the effectiveness of herbal medicine as a potential therapeutic approach for hypertension, offering an alternative or complementary solution to conventional pharmacological treatments. It highlights several natural agents that have demonstrated efficacy in lowering systolic blood pressure (SBP) in clinical and meta-analytical studies. The methodology involved a systematic review of articles that discuss herbal therapeutics for hypertension, focusing on their efficacy compared to placebo and standard treatments. The findings suggest that certain nutraceuticals, such as garlic, hawthorn, and CoQ10, can significantly reduce SBP, presenting a viable option for managing hypertension. This review underscores the need for further research to validate these findings and optimize herbal treatment strategies, potentially expanding the use of these natural products in clinical practice. The article aims to increase awareness among medical professionals and patients about the benefits and applications of herbal medicines in treating hypertension.

**Keywords:** hypertension; herbal medicine; nutraceuticals; lifestyle medicine

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## Introduction

Hypertension is a chronic disease of high blood pressure with among the highest prevalence of any chronic disease, affecting 18.5% of an adult sample in the province of Alberta, Canada [1]. Industrialized nations have higher rates of hypertension compared to non-industrialized nations, and several factors contribute to prevalence worldwide. In the USA, hypertension has been relatively flat, affecting roughly 30% of adults between the years of 1999 and 2010 [2]. Worldwide, it was estimated to affect 31.1% of adults (1.39 billion), and has a higher prevalence in low and middle income countries (LMICS, 31.5%) as opposed to high income countries (HICs, 28.5%) [3]. While age-standardized prevalence has decreased in high income countries by 10% for men and 6% for women between 2000 and 2010, it has increased in 35% for men and 29% for women during the same period in LMICS.

Hypertension is one of the strongest risk factors for all types of cardiovascular disease [4], where blood pressure greater than 140/90mm Hg is associated with a 54% increased risk of cardiovascular disease (CVD) events in patients with low pulse-wave velocity, and a 125% increased risk in patients with a high pulse wave velocity [5]. Risk factors for hypertension include a high salt intake[6], excessive alcohol consumption[7,8], and low fruit and vegetable intake[9]. Obesity[10] and being physically sedentary[11] are also risk factors for hypertension, as are smoking[12] and stress[13].

## Treatment

Diagnosis of hypertension is based on a measurement of systolic blood pressure (SBP) greater than 130 mm Hg [14], according to a 2017 Practice Guideline. As such, SBP is the typical outcome measure for trials on anti-hypertensives [15].

Standard treatment involves first making lifestyle changes, most importantly losing weight, adopting a diet rich in fruits, vegetables, whole grains and low-fat dairy products, reducing sodium intake, supplementing potassium, and reducing alcohol consumption if the patient drinks more than 2 drinks per day [14]. Additionally, adopting physical activity, including aerobic and resistance training, can lower blood pressure [14]. The interventions mentioned above can lower SBP in hypertensive individuals by between 4mm Hg and 11mm Hg each.

If this is insufficient to restore healthy blood pressure, pharmacological approaches may be used. The 2017 guidelines propose an initial antihypertensive treatment of a thiazide-type diuretic or CCB, and if necessary, adding additional hypertensive treatments to lower blood pressure below 130/80 mm Hg.

### Pharmacological Treatment

There are several options to choose for drug combinations to use for the patient's blood pressure to be below 130 mm Hg. These have been outlined in the 2017 guidance document and include several classes of blood pressure lowering medication: Thiazides, angiotensin converting enzyme (ACE) inhibitors, Angiotensin II Receptor Blockers (ARBs), calcium channel blockers (CCBs), and others. These agents have been demonstrated in clinical trials to significantly lower SBP with few side effects. For thiazides, side effects include electrolyte abnormalities [16,17], hyperglycemia[18], hypokalemia (potassium deficiency)[19], hyperlipidemia[20], high uric acid[20], hypercalcemia [21], hyponatremia (low sodium)[22], and possible magnesium deficiency[23].

Angiotensin Converting Enzyme (ACE) Inhibitors are associated with several adverse effects, including hypotension, renal dysfunction, hyperkalemia, and cough[24]. Other less frequent effects include angioedema, hepatotoxicity, skin rashes, and dysgeusia[24]. Angiotensin II Receptor Blockers (ARBs) are generally well tolerated, but side-effects include dizziness, headache, fatigue, gastrointestinal effects, joint pain, hyperkalemia, upper respiratory infections, and kidney problems[25]. Birth defects are possible when ACE inhibitors or ARBs are taken during pregnancy [26].

Calcium Channel blockers (CCBs) may cause adverse effects including edema, flushing, headache, dizziness, constipation, nausea, rash, and drowsiness[27].

### Herbal Treatment

Lifestyle medicine is an effective means of reducing hypertension, though results take some time to manifest. Many therapeutic agents have been identified which can help with hypertension.

### Methods

The methodology is to first find general reviews of herbal therapeutics for hypertension. These reviews provide a list of natural therapeutics for hypertension. Our search identifies 25 articles, included below in Table 1. The interventions for hypertension that are mentioned are shown in the right column of Table 1. Many of the interventions are repeated between general reviews.

General Review	Nutraceuticals
[28]	Garlic, Tea, Fiber, Fatty acids, Protein, Zinc, Calcium, Magnesium, Potassium, Shiitake and maitake mushrooms, seaweed, Vitamin C, Vitamin E, Vitamin D, Vitamin B6, Flavonoids, Lycopene, Coenzyme Q10, $\alpha$ -Lipoic acid, N-acetyl Cysteine, L-Arginine, Hawthorne, L-Carnitine, Taurine, Celery, Pycnogenol
[29]	Dietary Approaches to Stop Hypertension (DASH) diet plan, L-arginine, chlorogenic acid, fermented milk, garlic, onion, tea, soybean, ginger, hawthorn, fish oil

[30]	DASH diet plan, L-arginine, chlorogenic acid, fermented milk, garlic, onion, tea, soybean, ginger, hawthorn, fish oil, beetroot juice or extract, L-carnitine and Acetyl-L-carnitine, taurine, omega-3 fats (DHA and EPA), omega-9 fats (Olive oil), magnesium, zinc
[31]	DASH diet, L-arginine, chlorogenic acid, fermented milk, garlic, onion, tea, soybean, ginger, hawthorn, fish oil, pycnogenol, vitamin C, vitamin E, vitamin B6, coenzyme Q-10, lipoic acid, L-carnitine, taurine, L-arginine, trans-resveratrol, DHA, EPA, GLA, magnesium, zinc, lycopene.
[32]	Vitamins, garlic, lycopene
[33]	Soy isoflavones, aged garlic extract, lycopene, Pycnogenol, alpha-lipoic acid, slow-release melatonin, taurine, probiotics
[34]	Omega-3 fatty acids, fiber, polyphenols, phytosterols, red yeast rice, berberine, soy protein, coenzyme Q10
[35]	Potassium, garlic, curcumin, fish oil, pectin, docosahexaenoic acid, soya, magnesium, saffron, Vitamin C, nitrate, red wine, eicosapentaenoic acid, electrolytes, quercetin, Vitamin D, Tea, alpha lipoic acid, cinnamon, CoEnzyme Q10, Omega 3, pomegranate juice, onion, L-arginine, chocolate, pycnogenol
[36]	Calcium, Vitamin D, Resveratrol, Sodium/Potassium, Folic acid, Zinc, Melatonin
[37]	Policosanol, Red yeast rice extract, Berberine, Folic acid, Coenzyme Q10, Orthosiphon stamineus
[38]	Coenzyme Q10, pycnogenol, melatonin, green coffee, olive oil, lycopene, Chocolate, Beetroot juice, Vitamins, Minerals, Probiotics, Coenzyme Q10, Melatonin, Dried garlic, Green tea, Flaxseed, Resveratrol
[39]	Genistein, L-arginine, Berberine, Naringenin, Ellagic Acid, L-citrulline, Capsaicin, Xanthohumol, Chrysanthemic acid, Blueberry Extract, Quercetin
[40]	Polyunsaturated fatty acids, Isoflavones, Lactotripeptides, Fish peptides, L-Arginine, Potassium, Magnesium, Chelated magnesium, Calcium, Vitamin C, Cocoa flavonoids
[41]	Red yeast rice, Policosanol, Berberine, Folic acid, Coenzyme Q10
[42]	Aged garlic extract, beetroot juice, calcium (in pregnancy), chelated magnesium, cocoa flavonoids, coenzyme Q10, controlled-release melatonin, fish peptides, isoflavones, L-arginine, lactotripeptides, lycopene, polyunsaturated fatty acids, potassium, probiotics, pycnogenol, resveratrol, vitamin C.
[43]	Omega-3 polyunsaturated fatty acids, phytosterols, red yeast rice, berberine, soy protein, coenzyme Q10
[44]	Orthosiphon stamineus, policosanol, red yeast rice extract, berberine, folic acid, coenzyme Q10
[45]	Proanthocyanidins, Lycopene, Capsaicin, Garlic extracts, Spirulina, Barley, Fiber, Coenzyme Q10, Thiamine, Vitamin D, Omega-3 fatty acids, Polyunsaturated fatty acids, Beta-glucan, Plant sterols and stanols, Probiotics
[46]	Flavonoids, Beetroot, Garlic, Unsaturated fats, Omega-3 polyunsaturated fatty acids, Omega-9 monounsaturated fatty acids

[47]	Dark chocolate (flavonoids), Cocoa extract capsules (flavonoids), Beetroot juice, Powdered garlic extract, Aged garlic extract, Fish oils (omega-3 PUFA), Olive oil (omega-9 MUFA), Olive leaf extract (omega-9 MUFA)
[48]	Resveratrol, cocoa, quercetin, curcumin, brassica, berberine, Spirulina platensis
[49]	Vitamin D, Vitamin E, Vitamin B6, Vitamin B12, Vitamin C
[50]	Fiber, Milk Peptides, Meat Proteins, Soybean Proteins, Lupin Protein, Monounsaturated Fatty Acids (MUFA), Polyunsaturated Fatty Acids (PUFA), Omega-3 Fatty Acids (DHA and EPA), Ascorbic Acid (Vitamin C), Cholecalciferol (Vitamin D3), Magnesium, Zinc, Potassium, Pyridoxine (Vitamin B6), Tocopherol (Vitamin E), Polyphenols, Resveratrol, Curcumin, Berberine, Quercetin
[51]	L-arginine, Beetroot ( <i>Beta vulgaris</i> ), Calcium, Celery ( <i>Apium graveolens L.</i> ), Garlic ( <i>Allium sativum</i> ), Hawthorn ( <i>Crataegus laevigata</i> ), Magnesium, Olive leaf ( <i>Olea europaea</i> ), Potassium, Taurine, Vitamin C, Vitamin D, Vitamin E
[52]	Lycopene, Vitamin C, Vitamin E, Flavonoids (various types), Coenzyme Q10, Milk's tripeptides, Minerals (Calcium, Magnesium), Prebiotic Fibers (Inulin), Polyunsaturated Fatty Acids (various types)

The unique nutraceuticals included in Table 1 are compiled into Table 2. Table 2 also includes standard treatment drugs as included in the treatment guidelines for hypertension [14]. Values for change in SBP are compared vs placebo, or the comparison of standard treatment with the nutraceutical vs the control case of standard treatment alone. Exceptions are mentioned in parentheses. Nutraceuticals with a lowering of SBP greater than 4mm Hg are potential therapeutic agents, where agents with a smaller, yet statistically significant change are less likely to be therapeutically useful.

Pharmaceutical Standard Treatment	Change in SBP of pharmaceutical vs placebo [95% Confidence Interval]	Nutraceutical alternative	Change in SBP of nutraceutical vs placebo (mm Hg) [95% Confidence Interval]
Thiazide diuretics	19.2 [18.0, 20.3] [53] 12.4 [6.0, 18.8] [54]	Ashwagandha	No meta-analyses Isolated studies [55,56]
hydrochlorothiazide	8.5 [7.2,9.7] [57] 17.3 [15.7,18.8] [53]	Garlic	6.7 [1.0, 12.4]
Indapamide	11.8 [10.1,13.5] [58] 22.2 [20.6, 23.9] [53]	Hibiscus sour tea	7.6 [5.5,9.7] [59]
bendroflumethiazide	12.2 [11.4,13.0] [58]	Xiao Yao San	8.9[4.8,13.1] [60]
Chlorthalidone (CTDN)	13.2 [11.1, 15.3] [57]	Grape	3.2 [1.0,5.4] [61]
ACE inhibitor	12 [4,21] [54] 15.0 [12.7, 17.2] [53] 13.2 [12.9, 13.5] [53]	Panax ginseng	3.2 [2.3,4.2] [62]
Verapamil	13.3± 3.0 [63]	Chinese Herbal Medicine	7.5 [5.8,9.1] [64]
Captopril	9.7± 2.9 [63]	Mistletoe	8.9 [2.7,15.0] [65]

Benazepril	[66] Extract from	Nigella Sativa	3.3 (1.4, 5.1) [67]
Enalapril	15.0 [12.6,17.3] [53]	Zinc	1.5 [0.1, 2.9] [68]
Ramipril	15.0 [7.6, 22.4] [53]	Gingko Biloba Drops	13.5 [7.6,19.4] [69]
Fosinopril	10.2 [95% CI not available] [70]	Gingko Biloba Tablet	12.0[8.4,15.6] [69]
Calcium Channel Blockers (CCBs)	16.2 [15.6,16.9] [53] 15.9 [22.2,9.5] [54]	Gingko Biloba Capsule	9.7 [2.1, 17.3] [69]
Amiodipine	16.3 [15.7, 17.0] [53]	Garlic	6.7 [1.0,12.4] [71] 6.0 [0.8, 11.2] [72] 4.3 [0.3, 8.4] [72] 4.6 [1.9, 6.5] [73] 3.8 [2.5,5.0] [74] 9.1 [5.4, 12.7] [75] 5.5±1.9 [76] 8.7 ± 2.2 [77]
Lercanidipine	14.2 [11.6, 16.8] [53]	Aged Garlic Extract	11.5 [7.7, 15.3] [78]
Angiotensin II receptor blockers (ARBs)	13.2 [12.9, 13.5] [53] 10.7 [1.4, 20.0] [54]		
Candesartan cilexetil	14.2 [13.4, 15.0] [53]	Hawthorn	10.1 [7.4,12.8] [79]
Irbesartan	14.1 [13.2, 15.0] [53]	Danshen	9.0, [4.5,13.5] [80]
Losartan	12.7 [12.2, 13.3] [53]	CoQ10	16.6 [12.6,20.6] [81]
Valsartan	12.5 [11.4, 13.6] [53]	Vitamin C	3.8 [2.4, 5.3] [82]
Atenolol	14.8 [13.7, 15.9] [53]	Fish oil	3.0 [1.5,4.5] [83]
		er-xian decoction	7.8 [3.4, 12.3] [64]
		song ling xue mai kang capsule	10.3 [8.7, 11.8] [64]
		zhengan xifeng decoction-er-zhi pill	6.2 [3.3, 9.1] [64]
		liu wei dihuang pill	8.1 [5.9, 10.3] [64]
		xiao yao pill	17.7 [14.7, 20.7] [64]
		suanzaoren decoction	11.0 [8.2, 13.8] [64]
		wen dan decoction	10.0 [5.8, 14.2] [64]
		tonifying kidney and activating blood decoction	7.0 [4.2, 9.8] [64]
		tonifying kidney, nourishing yin and activating blood decoction	7.0 [4.1, 9.9] [64]

	clearing heat and activating blood decoction	7.1 [3.8, 10.4] [64]
	soothing the liver decoction	10.0 [3.7, 16.3] [64]
	calming liver, nourishing yin and tranquilizing mind decoction	5.0 [1.9, 8.1] [64]
	wuling capsule	11.6 [7.8, 15.4] [64]
	nourishing kidney and calming liver decoction	14.5 [5.6, 23.4] [64]
	nourishing yin and restoring blood decoction	11.1 [6.7, 15.6] [64]
	nourishing yin and suppressing yang decoction	12.0 [7.4, 16.6] [64]
	Alpha Lipoic Acid	
	Vitamin C	5.0 [1.5, 8.6] [84]
	Beta-Glucan Fibre	2.9 [0.9, 4.9] [85]
	Beetroot	5.0 [1.0, 8.9] [86]
	Berberine	11.9 [7.1, 16.6] [87] (relative to metformin) 6.0 [2.7, 9.2] [88]
	Blueberry	n.s. [89]
	Calcium	1.9 [0.8, 2.9] [90]
	Capsaicin	n.s. [91]
	Celery stem extract	21.5 [13.2, 29.9] [92]
	Magnesium	3 to 4 [93] 4.3 [2.2, 6.3] [94] 2.0 [0.4, 3.6] [95]
	Chlorogenic Acid	4.3 [3.0, 5.6] [96]
	Chocolate	4.5 [3.2, 5.9] [97]
	Coenzyme Q10	16.6 [12.6, 20.6] [81]
	Cocoa	2.8 [0.3, 5.3] [98]
	Controlled release melatonin	n.s. [99] 3.6 [0.7, 7.9] [100]
	Curcumin	n.s. [101]
	eicosapentaenoic acid (EPA)	2.6 [0.5, 4.6] [102]
	docosahexaenoic acid (DHA)	3.1 [0.2, 5.9] [102]

	Dietary Approaches to Stop Hypertension (DASH) diet	6.7 [5.2,8.3] [103]
	ellagitannin-rich fruit	n.s. [104]
	Fish oil	2.6 [0.6, 4.5] [105]
	Food peptides	5.1 [3.1,7.1] [106]
	Flavonoid rich fruits	n.s. [107]
	flaxseed	2.9 [0.3,5.4] [108] 1.8 [0.1, 3.5] [109]
	Folic Acid	2.0 [0.4, 3.6] [110]
	Genistein	n.s. [111]
	Ginger	6.4 [1.5,11.3] [112]
	Green Tea	2.1 [1.1,3.1] [113] 1.9 [0.9,3.0] [114] 2.0 [1.0,2.9] [115] 1.2 [0.2,2.2] [116]
	Green coffee extract	3.1 [1.8, 4.4] [117] 3.1 [2.3, 3.9] [118]
	Isoflavones	n.s. [119] 1.9 [0.4, 3.5] [120]
	l-arginine	5.4 [2.3, 8.5] [121] 6.4 [4.1, 8.7] [122] n.s. (in pregnant women) [123] 5.0 [2.1,7.9] [124] (post-exercise SBP)
	l-carnitine	n.s. [125] n.s. [126]
	l-citrulline	4.1 [0.3, 7.9] [127] n.s. [128]
	Lactotripeptides	3.0 [1.7, 4.2] [129] 1.3 [0.5, 2.1] [130] 3.7 [1.8, 6.7] [131] 1.3 [0.1, 2.5] [132] 4.0 [2.1, 5.9] [133] 5.6 [4.4,6.9] [134] 4.8 [3.7, 6.0] [135] 3.4 [2.3, 4.5] [136] (non-hypertensive population) n.s. [137]

		3.4 [1.2, 5.6] [138]
Lycopene		5.9 [2.6, 9.1] [139] (tomato extract) 2.6 [0.1, 5.2] [140] 5.0 [1.1, 8.8] [141] 5.7 [2.0, 9.3] [142] 5.6 [0.3, 10.9] [143]
Melatonin		3.4 [1.1, 5.8] [144]
Monounsaturated fatty acids (MUFA)		2.3 [0.3,4.3] [145] n.s. [146]
Motherwort oil		15.1 [12.1, 18.1] (stage 1 hypertension, change from baseline) [147] 11.7 [9.3, 14.1] (stage 2 hypertension, change from baseline) [147]
Nattokinase		3.5 [2.2, 4.4] [148]
Omega 3		4.5 [2.8, 6.1] (untreated hypertensive patients) [149] 2.6 [1.7, 3.6] [150] 1.2 [0.6,1.8] [151]
Olive Oil		n.s. [152]
Olive leaf extract		4.5 [1.6,7.4] [153] 3.9 [1.3, 6.4] [154]
Onion		Significant effect [155]
Phytosterols		1.6 [0.4, 2.7] [156]
Grape polyphenols		1.5 [0.2, 2.8] [157]
Polyphenols		3.7 [3.2,4.2] [158]
Policosanol		3.4 [1.5, 5.3] [159]
Potassium		4.5 [3.1, 5.9] [160] 4.3 [2.5, 6.0] [161] 4.7 [2.4, 7.0] [162] 3.3 [1.6, 4.9] [163]
Inulin		n.s. [164]
Proanthocyanidins		4.6 [1.1, 8.0] [165]
Probiotics		2.1 [0.2, 3.9] [166]

		1.6 [-0.1, 3.1] [167] 5.6 [1.5, 9.8] [168] 3.1 [1.4, 4.7] [169] 3.6 [0.7, 6.5] [170] 3.1 [1.6, 4.6] [171] 3.1 to 5.0 [172] 2.0 [1.1, 2.8] [173] 2.2 [0.9, 3.4] [174] 2.7 [0.5, 5.0] [175] 3.3 [1.2,5.4] [176]
	Pycnogenol	3.2 [0.2, 6.2] [177] 2.5 [1.0, 4.1] [178] 3.2 [0.9,5.5] [179] n.s. [180]
	Quercetin	2.4 [1.0, 3.8] [181] 3.0 [0.3, 5.8] [182] 1.7 [0.2, 3.2] [183]
	Red Wine Polyphenols	2.6 [0.4, 4.8] [184]
	Red Yeast Rice	3.3 [0.0, 6.7] [185]
	Resveratrol	n.s. [186] 11.9 [2.8, 21.0] [187]
	Saffron	0.7 [0.2, 1.1] [188]
	Seaweed	n.s. [189]
	Soy	2.2 [0.3, 4.1] [190] 1.7 [0.1, 3.3] [191]
	Spirulina	4.6 [1.0, 8.2] [192]
	Tea	4.8 [1.6, 8.4] [193] 2.4 [0.5, 4.2] [194] n.s. [195]
	Taurine	3 [range 0 to 15] [196] 4.7 [0.3, 9.1] [197]
	Tocopherol (Vitamin E)	3.4 [0.1, 6.7] [198]
	Vitamin D	n.s. [199] n.s. [200]

This work has the limitation of reporting prior meta-analyses, and not performing a de-novo meta-analysis for each compound, which would be quite taxing. In the case where new trials have taken place, the meta-analysis value may be changed by inclusion of the new trial, but attempts are made to include the most recent and thorough meta-analyses.

Including such a wide variety of meta-analyses introduces a significant degree of heterogeneity in treatment length, dosages, and therefore effect sizes. Individual meta-analyses do often pool together heterogenous treatment regimens, which is usually chosen to be therapeutically relevant.

Additionally, given the confidence intervals on these values, it can be expected that some of the significant results found are spurious, which is why it is recommended to prioritize agents with a 95% confidence interval much greater than zero, or alternatively a low p-value. Several therapeutic agents may lack significant power in their trials, and results relying on few trials may mistakenly show a larger effect than what can normally be expected.

These caveats are quite standard to the reporting of any meta-analysis result, however, and weighing evidence is a standard part of meta-analysis, so these limitations are not overly damaging to this article as a summary work on herbal treatments for hypertension.

## Conclusion

Several therapeutic agents have been identified as having potential value in treating hypertension and may warrant further investigation. This work aims to motivate further research into alternatives for anti-hypertensive drugs. Future work includes further trials to verify clinical efficacy, as well as potential combinations and modifications of therapies for maximum effect.

Given that these are unfamiliar therapeutics for many practitioners, educational resources may be a useful means of communicating the potential value of using herbal therapeutics in antihypertensive treatment to both patients, medical professionals and caregivers. It is possible that new markets, or expansions of existing markets, for herbal products may emerge given the greater awareness of the therapeutic potential for antihypertensive nutraceuticals.

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