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Review Article

Holistic approaches in the management of Hypertension: An Evidence-Based Narrative Review

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Abstract

Introduction: Hypertension a growing public health challenge and a leading risk factor for cardiovascular morbidity and mortality with around 10.8 million deaths attributable to it per annum. Despite effective pharmacological therapies, long-term use is often associated with side effects and poor compliance. *Ayurveda* offers a holistic approach. Objective of this review was to assess evidence from available *Ayurvedic* intervention for management of hypertension. Materials and methods: A narrative review was undertaken using electronic databases PubMed, Scopus and Web of Science for studies published till December 2024. Eligible studies included randomized controlled trials, observational studies and case reports during which *ayurvedic* interventions, herbal formulations, *Panchakarma* therapies and lifestyle modifications were evaluated. Study selection was made according to predetermined eligible criteria. Results: A total of 20 studies fulfilling predefined inclusion criteria were included. Herbal formulations including *Sarpagandha*-based preparations, *Brahmi Vati* and polyherbal combinations demonstrated significant reductions in systolic and diastolic blood pressure. *Panchakarma* therapies including *Basti, Virechana* and *Shirodhara* showed beneficial effects on cardiovascular parameters including blood pressure. Lifestyle interventions including *yoga*, *pranayama* and dietary modifications contributed to improved blood pressure control, stress reduction and overall well-being. Discussion: *Ayurvedic* interventions offer promising complementary approaches in managing hypertension. However there were several limitations including small sample sizes, heterogeneity in interventions and variability in study designs. More large-scale, well-designed clinical trials are needed to confirm their efficacy and incorporation into conventional practice.

Keywords: Hypertension, *Ayurveda*, Essential Hypertension, *Yoga*, Diet

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Introduction

High blood pressure or Hypertension (HTN) is one of most significant and modifiable risk factors for many cardiovascular diseases. It is labelled as major global health concern responsible for around 10.8 million deaths annually (1,2). Over past few years number of people with high blood pressure has doubled from 650 million in 1990 to 1.3 billion by 2019. Today nearly one in every 3 adults around the world is affected by this condition (3,4). Similarly Hypertension is found to be significantly common in India. According to 2019–2020 National Family Health Survey (NFHS-5) hypertension prevalence of 24% in men and 21% among women, an increase from 19% and 17% respectively from the previous round (2015–16) (5).

HTN is diagnosed when systolic blood pressure is above 140 mm of Hg and diastolic blood pressure above 90 mm of Hg (6) and pre-HTN ranges falls between 130-139 mm of Hg and 85-89 mm of Hg systolic and diastolic blood pressure respectively. Even pre-HTN is said to be associated with more than two fold increase in risk of cardiovascular disease as compared to those blood pressure falls within normal range i.e. below 120/80 mmHg (7).

Depending on underlying cause hypertension is of two types Primary and Secondary HTN. Primary also known as essential HTN which means elevated blood pressure with no any identifiable underlying cause. Although Primary HTN contribute to most of the cases whereas secondary HTN contribute around

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5-10% of cases i.e. secondary to an identifiable cause like Endocrine, Renal, Coarctation of aorta, Pregnancy and drug induced hypertension etc. (8). The exact mechanism of primary HTN remains unclear. However widely accepted explanation involves altered sympathetic nervous system activity which is likely to contribute in pathogenesis of primary HTN. Genetic factors (such as family history), Psychosocial factor (such as stress) and Lifestyle factors (such as physical inactivity) are known to alter sympathetic activity (9).

Although HTN is diagnosed instrumentally, it typically remains asymptomatic in most of the cases and is often referred as "silent killer" (10). In some cases it exhibits symptoms which include headache, giddiness, palpitations and fatigability etc. In severe cases, it exhibits symptoms like blurred vision, chest discomfort, severe headache and confusion etc. (11).

In contemporary science current treatment approach includes the use of various pharmacological agents such as beta-blockers, Calcium Channel Blockers (CCB's), Angiotensin-converting enzyme inhibitor (ACEI), Angiotensin II receptor blocker (ARB), Thiazide-type diuretics. Though this conventional treatment have proved to be satisfactory, they often requires lifelong use. This lifelong use is often associated with side effects and poor compliance to antihypertensive medications (12-14). Hence there is a need to find safer and effective alternative therapy. Studies have found that incidence of use of alternative and complementary system of medicine in chronic disorders is up to 48% in patient population (15).

The ultimate aim of managing HTN is to reduces cardiovascular morbidity and mortality. This can be addressed through medication along with lifestyle changes (such as weight reduction, stress management) and dietary modifications (16). This can be achieved through *Ayurveda* as Ayurveda stresses the importance of lifestyle, diet along with medicinal intervention for prevention and management of lifestyle related diseases.

Though there is no direct reference regarding HTN in the classical literature of Ayurveda. Several attempts have been made to explain and correlate hypertension from Ayurveda perspectives including *Vyana Bala Vaishamya, Raktagata Vata, Dhamani Pratichaya* etc (17). Several studies and articles have documented Ayurvedic approaches in the management of hypertension. Hence this review has been undertaken to provide *Ayurvedic* practitioners with a concise overview and guidance for the effective management of hypertension from an Ayurvedic perspective. Objective of this review was to assess evidence from available *Ayurvedic* intervention for management of hypertension

Methodology

A comprehensive electric literature search was done on electronic databases PubMed and Scopus identifying all the sources that met the selection criteria published within 15 years till December 2024. Published studies of RCTs, Pre and Post-Clinical trials, Case reports and Observational clinical trials in English language were considered based on their eligibility. Relevant key words such as Hypertension, prehypertension, Essential Hypertension, blood pressure, *yoga*, diet, Ayurveda were used to search the literature in an iterative fashion using Boolean operators such as *OR* and *AND*. Relevant filters were used in isolating clinical trails. The search of the various databases retrieved 33 articles. The results of search carried out using different databases were compiled in one file. The screening of titles and abstracts was rigorously undertaken by two investigators to identify studies to be included in this article based on language, full-text content, accessibility, outcome/dataset and the absence of meeting the required baseline BP levels and year of article publication. Out of the shortlisted 33 articles, 3 duplicate studies were removed in the process of the screening. Out of the remaining 30 papers, 9 articles were excluded because the full paper was not accessible (available only in an abstract form). Out of 21 remaining articles and one article, sitting variation in the outcomes was eliminated. In the end, 20 article were retrieved which satisfied our inclusion criteria. Data extraction was performed independently by two review authors using a predetermined data extraction template that included basic study characteristics (e.g., author, study design, etc.), participants characteristics, intervention characteristics, outcome measures, and analysis and other details. The process of selection by inclusion and exclusion criteria of the identified articles contained in several databases is described in the PRISMA flow chart **[Figure 01].** A table has been provided with a summary of the articles included in this review **[Table 01].**

Figure 01. PRISMA flow chart

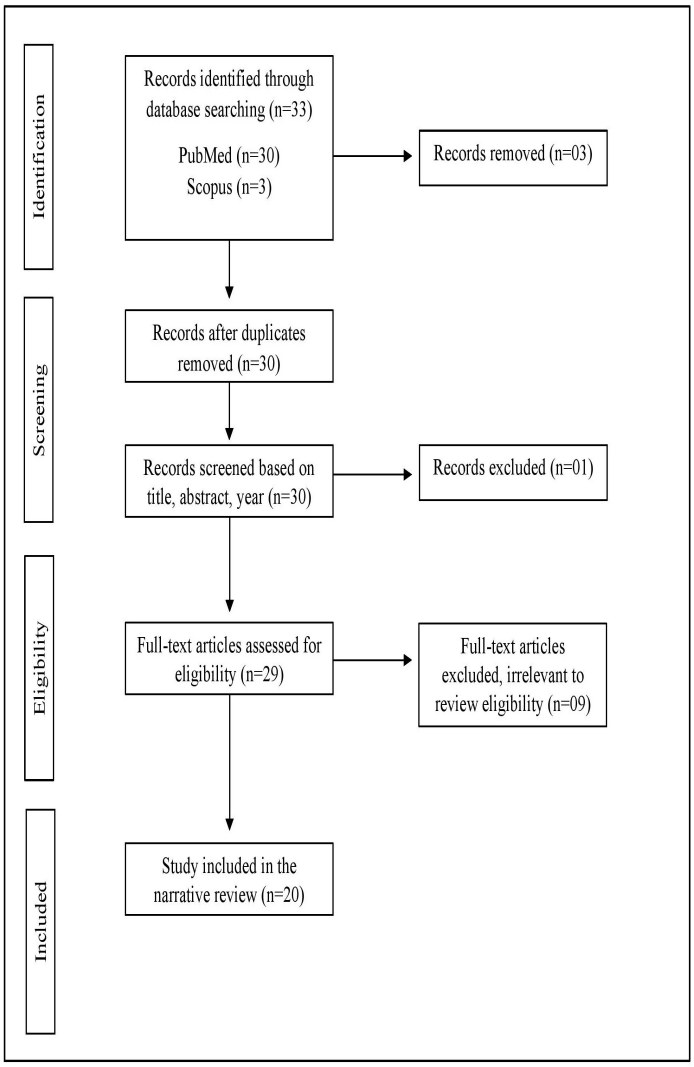

Table 01: Summary of the articles included in this review

Title of Paper	Study Design	Author	Year	Sample Participants	Intervention	Duration	Result
Effect of Ayurveda intervention in the integrated management of essential hypertension (18)	Retrospective observational	*Sharma R et* al.	2021	1938	Group I: Received standard care (conventional antihypertensive medications) along with lifestyle modifications and *Yoga.* Group II: Received standard care, lifestyle modifications, *Yoga* and additional Ayurveda medications: · M-*Sarpagandha Mishran* (250 mg) – a polyherbal formulation containing *Sarpagandha, Jatamansi, Vacha, Punarnava, Brahmi, Shankhpushpi* and *Guduchi.* · *Pravala Pishti* (250 mg) – a mineral preparation made from purified coral and rose water.	3 months	Study showed that integrating Ayurveda (M-*Sarpagandha Mishran* and *Pravala Pishti*) with *Yoga* and lifestyle changes led to significantly better blood pressure control. In the Ayurveda group, 36.7% of patients were able to completely stop conventional antihypertensive medications, and 30.4% reduced their dosage
Effect of *Brahmi vati* and *Sarpagandha Ghana vati i*n management of essential hypertension (19)	Randomized Double-Blind Clinical Study	*Mishra D et* al.	2019	60	Group I: Received *Brahmi Vati* 500 mg twice a day Group II: Received *Sarpagandha Ghana Vati* 500 mg twice a day	30 days	Both *Brahmi Vati* and *Sarpagandha Ghana Vati* significantly improved SBP, DBP, MAP, anxiety, sleep profile and total cholesterol. *Brahmi Vati* increased weight and BMI, while *Sarpagandha Ghana Vati* reduced total cholesterol and LDL. Both had a good safety profile.
A comparative study of *Shankhapushpyadi Ghana Vati* and *Sarpagandhadi Ghana Vati* (20)	Comparative Clinical Study	*Mishra J et* al.	2012	40	Group I: Received *Shankhapushpyadi ghana vati* 2gm/daily Group II: Received *Sarpagandha Ghana Vati* 2gm/daily	30 days	Both *Shankhapushpyadi Ghana Vati* and *Sarpagandhadi Ghana Vati* improved symptoms and lowered BP. Group B (*Sarpagandhadi*) showed slightly better BP reduction (12% SBP, 11.02% DBP) compared to Group A. Overall, both were found equally effective
Clinical evaluation of herbomineral compound *'Rakatchap Har'* (21)	Open-label pilot study	*Nandha R et* al.	2011	30	*Rakatchap Har* 500mg twice daily (contains *Sarpagandha, Jatamansi, Shankhapushpi, Johar Mohra Pishti, Moti Pishti, Ras Sindoor*)	60 days	After 8 weeks of treatment with *Rakatchaphar* (500 mg twice daily), patients showed a significant reduction in blood pressure: SBP dropped from 164.16 to 122.98 mmHg, DBP from 101.88 to 80.90 mmHg, MBP from 122.27 to 94.86 mmHg ($P < 0.0001$). The formulation was found to be effective and safe for managing essential hypertension.
Efficacy of Heart Revival, an Ayurvedic Formulation (22)	Single-arm open-label Exploratory trial	*Pandit S et* al.	2024	50	5 ml of Heart Revival once daily, orally at the time of bed Contains *Arjuna* (*Terminalia arjuna* (Roxb.) Wight & Arn.), *Ashwagandha* (*Withania somnifera* (L.) Dunal), *Lahsun* (*Allium sativum* L.), *Anar* (*Punica granatum* L.), Giloy (*Tinospora cordifolia* (Willd.) Hook. f. & Thomson), *Amla* (*Phyllanthus emblica* L.), *Guggulu* (*Commiphora wightii* (Arn.) Bhandari) and *Dasmula* (a group of ten *Ayurvedic* medicinal plants)	3 Months	Heart Revival, a polyherbal formulation, significantly reduced blood pressure, lipid levels, and symptoms like fatigue, chest discomfort, and breathlessness within 8 weeks. It was found to be safe and effective for managing hypertension and hypercholesterolemia, with potential benefits in cardiovascular disease management
Management of Essential Hypertension with *Raktadushtihar Yoga* (23)	Prospective Open labelled Observational Study	*Avhad AD et* al.	2019	50	*Raktadushtihar Yoga* (tablet) was given in the dose of 2 grams twice a day (containing *Sariva*, *Musta*, *Katuka*, *Patha* and *Patola*)	30 day	After one month of treatment with *Raktadushtihar Yoga*, systolic BP decreased by 12.90% and diastolic BP by 11.19%. Significant improvement was also observed in symptoms like headache, blurred vision, dizziness and irritability. The formulation proved effective in reducing both systolic and diastolic blood pressure in hypertensive patients.

Clinical efficacy of *Coleus forskohlii* (Willd.) Briq. (*Makandi*) in hypertension (24)	Open-label Clinical trial	*Jagtap M et* al.	2011	41	Group I received *Makandi Ghana vati* 500mg thrice daily Group II received *Makandi Churna* tablet 700mg thrice daily	60 days	Both forms of *Makandi* (*Ghanavati* and *Churna* tablet) were effective in managing hypertension, with improvements in blood pressure, psychological factors, and geriatric symptoms. Overall, Group I showed slightly better results, with 76.19% of patients mildly improved compared to 75% in Group II.
Efficacy of Nardostachys *Jatamansi* in Essential Hypertension (25)	Single blind randomized, placebo controlled study	*Bhat MDA et* al.	2020	60	Participants were randomly assigned to receive 3 grams of *Nardostachys jatamansi* (D. Don) DC daily (1 capsule taken three times a day) or a placebo for a duration of 4 weeks.	6 weeks	After 4 weeks of treatment, Nardostachys *jatamansi* significantly reduced both systolic and diastolic blood pressure in patients with essential hypertension, while no significant changes were observed in the placebo group. It also improved quality of life, as shown by reduced MINICHAL scores. The findings support its effectiveness
The role of psychic factors in pathogenesis of essential hypertension and its management by *Shirodhara* and *Sarpagandha Vati* (26)	Randomized Open clinical controlled trial	*Kundu C et* al.	2010	40	Group A: *Shirodhara* by *Bala Taila* was administered for 30 min each day for 7 days; there were three such sessions, with 3-day intervals between sessions. Thus the total period of treatment was for 21 days. Group B: *Sarpagandha Vati* (each 250 mg), two Vati twice daily for a total duration of 30 days.	30 days	The impact of the treatment on primary and associated symptoms was assessed, revealing that the *Shirodhara* group showed greater improvement compared to the *Sarpagandha Vati* group. While both interventions were effective in lowering systolic and diastolic blood pressure, *Shirodhara* demonstrated a more pronounced effect
A clinical study on the effect of *Triphaladi Kala Basti* with *Arjuna Punarnavadi Ghanavati* (27)	Single-arm clinical study	*Hivale US et* al.	2018	30	Fifteen patients diagnosed with essential hypertension based on JNC 7 and WHO guidelines were treated using *Triphaladi Basti*, followed by oral administration of *Arjuna Punarnavadi Ghanavati*	24 days	Administration of *Basti* and *Arjuna Punarnavadi Ghanavati* were effective in reducing both systolic and diastolic blood pressure level which was highly significant ($P < 0.001$).
Efficacy of *Virechana* and *Basti Karma* with Shamana therapy in the management of essential hypertension: A comparative study (28)	Comparative clinical trial	*Shukla G et* al.	2013	60	A randomized open clinical trial was carried out on 33 patients with uncomplicated essential hypertension. Participants were divided into two groups: Group A (16 patients) received *Virechana Karma* using *Trivrita, Aragvadha, Eranda Taila*, and *Draksha Kwatha*; Group B (17 patients) received *Dashmoola Kala Basti —Niruha Basti* with Dashmoola Kwatha and *Anuvasana Basti* with *Dashmoola Taila*. After these therapies, both groups were given *Arjunadi Ghanavati* as follow-up treatment	30 days	The overall effect of the therapies on systolic and diastolic blood pressure showed that *Virechana* proved better relief (43.75%) as compared to Basti (29.41%). Although both the groups showed significant refuction in blood pressure.
Effect of om chanting and *yoga nidra* on blood pressure and lipid profile in hypertension (29)	Randomized Controlled Trial	*Anjana K et* al.	2022	60	Eighty hypertension patients were randomly assigned to two groups. The experimental group practiced OM chanting and *Yoga Nidra* five days a week for two months, while the control group continued their usual medications. Blood pressure and lipid profile were measured at the start, 30 days, and 60 days.	8 weeks	After 2 months, the group practicing OM chanting and *Yoga Nidra* showed a significant drop in blood pressure and LDL, along with an increase in HDL, compared to the control group. No side effects were reported. The study suggests these *yoga* practices are effective and safe as supportive therapy for managing hypertension.
Effect of *Yoganidra* on Blood Pressure, Hs-CRP and Lipid Profile of Hypertensive Subjects: A Pilot Study (30)	Pilot Study	*Devraj JP et* al.	2021	74	The experimental group (n=31) practiced *Yoga Nidra* for 45 minutes daily over 12 weeks under supervision, while the control group (n=43) received no intervention.).	12 weeks	After 12 weeks of *Yoga Nidra,* the experimental group showed a significant reduction in both systolic and diastolic blood pressure, along with a marked decrease in Hs-CRP levels. While changes in triglycerides and total cholesterol were not significant, LDL-C and HDL-C showed improvement. No adverse effects were reported.

Effects of *Nadishodhana* and *Bhramari Pranayama* on HRV, ART and BP (31)		*Upadhyay J et* al.	2023	100	In a study of 100 pre-diagnosed hypertension patients, Group 1 practiced *Nadi Shodhana Pranayama* and Group 2 practiced *Bhramari Pranayama* for 20 minutes. Heart rate variability and auditory reaction time were measured before and after the intervention.	4 weeks	The study found that both *Nadi Shodhana* and *Bhramari Pranayama* significantly reduced auditory reaction time, with *Bhramari* showing a stronger effect. Though heart rate variability didn't change significantly, both practices may help regulate autonomic balance and support hypertension management
Effect of slow breathing and PMR technique in essential hypertension (32)	Randomized Controlled Trial	*Pathan FKM et* al.	2023	60	Sixty-four participants diagnosed with essential hypertension were randomly allocated into Slow breathing excercise, Progressive muscle relaxation, Slow breathing exercise-Progressive muscle relaxation and Control groups received no treatment, with 16 subjects each.		The study found that combining Slow breathing Exercise (SBE) and Progressive Muscle Relaxation (PMR) significantly reduced heart rate, respiratory rate, blood pressure and anxiety in hypertensive patients. While individual techniques also showed improvements, the combination of SBE and PMR was more effective than either alone.
BP normalizing effect of *Talahridaya marma* therapy: A case report (33)	Case Report	*Gautam AS et* al.	2021	1	The volunteer received *Talahridaya marma* therapy, where the *Talahridaya marma* point on the left upper limb was stimulated for 10 days. The patient was also taught how to perform the therapy on themselves.	10 days	Rapid normalization of BP; immediate calming effect observed; case suggests promising neural-cardiac link via marma stimulation.
Comparison of the DASH diet and a higher-fat DASH diet on blood pressure and lipids and lipoproteins (34)	Randomized Controlled Trial	*Chiu S et* al.	2016	36	DASH vs high-fat DASH	12 weeks	Both diets lowered BP significantly; high-fat DASH diet improved HDL without negative lipid effects offering flexibility for dietary preference.
Effects of the DASH Diet and Walking on Blood Pressure in Patients With Type 2 Diabetes (35)	Randomized Controlled Trial	*Paula TP et* al.	2015	55	DASH diet along with Walking	8 weeks	Combined intervention significantly reduced systolic and diastolic BP along with improved glycemic control
Effectiveness of a multifactorial intervention: The MEDICHY study (36)	Randomized Controlled Trial	*Unda Villafuerte F et* al.	2020	123	Self-monitoring, diet, exercise, medication adherence.	12 months	Multifactorial intervention resulted in better long-term BP control and medication compliance

Results

Overview of Studies

From 20 included in the review, 14 studies were RCT's, 1 were case report, 3 were pre- and Post-clinical trials and 2 were observational trials. Out of 14 included RCTs, 2 studies were single blind while one was single blind along with one pilot study, remaining were non-blind studies. Out of 2 observational studies, one was prospective while the other was retrospective. From 20 included studies, 11 were pharmacological interventions and 9 were non-pharmacological interventions. Among 11 pharmacological studies, 2 were followed by classical formulation, 5 studies were based on polyherbal formulation and 3 were based on *panchakarma* modalities and 1 was integrative. Among 9 non-pharmacological intervention studies, 6 studies were based on *yogic* intervention, 3 were based on modified diet-based intervention. Summary of this intervention mentioned in a table **[Table 02].**

The diagnostic criteria for hypertension in most of the studies were found similar which were based on 7th JNC guidelines. Some studies were also mentioned WHO criteria and some studies followed ESC/AHA criteria. The primary inclusion criteria in all the studies were similar including diagnosed cases of hypertension (Blood Pressure more than 140 mm of Hg systolic and 90 mm of Hg diastolic), some studies included prehypertension criteria and cases between age group of 30-70 years. The exclusion criteria were almost similar i.e. individual with any systemic disease and comorbidities. Primary assessment criteria in all the studies were similar i.e. systolic and diastolic blood pressure with mean arterial pressure were also followed in some articles.

A total of 20 studies were identified. The sample sizes ranged from 01 to 2000 participants. Interventions were categorised into herbal formulations, *Panchakarma* therapies and lifestyle regimens.

Herbal Formulations

The findings of the reviewed interventional trials indicate that the blood pressure reduced remarkably after the intervention of the different herbal products of *Ayurveda*. The results in various clinical designs such as randomised controlled trials, case studies are summarised as follows:

Table 02: Classification of Studies based on the type of Intervention			
Type of Intervention			Number of Studies
Pharmacological			-
	Panchakarma and External therapies		3
		Virechana	1
		Basti	2
		Shirodhara	1
	Shamana		7
		M Sarpagandha Mishran	1
		Praval Pishti	1
		Shankhapushpyadi Ghana Vati	1
		Sarpagandha Ghana Vati	3
		Rakatchap Har	1
		Heart Revival Suspension	1
		Brahmi Vati	1
		Arjuna Punarnavadi Ghanavati	1
		Raktadushtihar Yoga	1
		Makandi	1
Non-pharmacological			9
	Yoga		3
		Asana	1
		Pranayama	2
		Om Chanting	1
		Yoga Nidra	2
	Talahridaya marma		1
	Diet		2
		DASH diet	1
		Less sodium diet	1

M-*Sarpagandha Mishran, Praval Pishti*

In a retrospectively designed observational study on 1,938 participants in an integrated project of NPCDCS and *Ayurveda* practices, patients who were given *Ayurvedic* medicines as supportive drugs in addition to conventional medication with lifestyle modification and *yoga* (Group II) showed significant difference in systolic and diastolic blood pressure ($p < 0.01$). Moreover, 36.7 percent of individuals in this group also had the possibility of withdrawing standard antihypertensive drugs to 15.1 percent in the standard care group (18).

Sarpagandha Ghana Vati* and *Brahmi Vati

A randomized and double-blind clinical trial (n=68) compared the activities of *Brahmi Vati* and *Sarpagandha Ghana Vati*. Both the formulations showed incredible results in reducing the SBP, DBP and mean arterial pressure in 30 days of usage. *Brahmi Vati* improved the quality and quantity of sleep and decreased anxiety and *Sarpagandha Ghana Vati* showed extra effects of lipid lowering. No unfavourable effects were recorded either group (19).

Shankhapushpyadi Ghana Vati* and *Sarpagandhadi Ghana Vati

A single-blind randomized controlled trial (N=20) demonstrated that both formulations statistically decreased blood pressure after 8 weeks. The Systolic BP reduced by 12.00 in the *Sarpagandhadi Ghana Vati* and by 8.91 in *Shankhapushpyadi Ghana Vati* group. Diastolic BP was reduced by 11.02 percent and 8.44 percent respectively. Both populations had an improvement in subject symptoms without adverse effects (20)

***Rakatchap Har* (Herbo-mineral Formulation)**

A prospective observational study (n=98) evaluated the efficacy of *Rakatchap Har*, a polyherbal herbal-mineral formulation. After 8 weeks, mean SBP decreased from 164.16 mmHg to 122.98 mmHg and DBP from 101.88 mmHg to 80.90 mmHg ($p < 0.0001$). The formulation, which includes *Sarpagandha, Shankhapushpi* and *Jatamansi* among others, was well tolerated (21).

Heart Revival Suspension

The present arm of the study is a single-arm open-label trial where polyherbal formulation (Heart Revival) consisting of cardioprotective herbs, namely, *Arjuna, Ashwagandha, Lahsun*, etc. was administered in the treatment of the patients with mild to moderate cardiovascular risks, including hypertension. The research showed a major positive effect in blood pressure, lipids and cardiac functional indices. Although no quantitative data was presented regarding blood pressure, general results were in favour of the intervention (22)

Raktadushtihar Yoga

In a single-arm clinical trial completed on 47 newly diagnosed hypertensive patients, the systolic BP decreased by 12.90 percent and diastolic BP by 11.19 percent after one month of *Raktadushtihar Yoga* (2 gm twice daily) as compared to the baseline. The composition of the compound is *Sariva, Musta, Katuki, Patha* and *Patola*. It was seen to provide symptomatic relief in the form of headache, giddiness and blackouts (23).

***Coleus forskohlii* (Willd.) Briq. (*Makandi*)**

A comparative study in clinical status was conducted to evaluate *Makandi* root in *Ghana Vati* and *Churna* tablet preparations in patients with old age (n=41). These two forms were effective in lowering diastolic and systolic BP. Group I (*Ghanavati*) had an improvement that was a bit better. A total of 76.19 and 75.00 percent of the patients in Groups I and II respectively were mildly improved. Possible adverse events were not reported (24).

Nardostachys Jatamansi

In a single-blind, placebo-controlled trial, 40 people with hypertension took *Nardostachys jatamansi* (3 g/day during 4 weeks) and experienced significant declines in their systolic and diastolic blood pressure, as well as the quality of life (MINICHAL score). In the placebo group, no significant changes were recorded. The results indicate that N. *jatamansi* could be a good natural antihypertensive drug (25).

Panchakarma Therapies

There are few *Panchakarma* modalities which have been tested clinically in the management of essential hypertension. The treatments involved, mostly, *Shirodhara*, *Basti* and *Virechana* procedures with internal medication. Summaries of findings of the individual, selected interventional studies are as follows:

Shirodhara* using *Sarpagandha Vati

The effectiveness of medicinal oil based *Shirodhara* compared *to Sarpagandha Vati* was done in 40 participants using a randomised clinical research. Both types of blood pressure systolic and diastolic decreased in both groups significantly ($p < 0.05$). Besides, anxiety ratings on Hamilton Anxiety Rating Scale were significantly reduced among *Shirodhara* group members,

signifying that therapy is effective in reducing sympathetic hyperfunction caused by stress (26)

Triphaladi Kala Basti* with *Arjuna Punarnavadi Ghanavati

Arjuna Punarnavadi Ghanavati was one, whereby in a clinical study conducted on 15 patients and *Triphaladi Kala Basti* was delivered orally as per predetermined duration after delivery. The study also found that systolic and diastolic blood pressure readings were significantly lower after intervention ($p < 0.001$). Wonders such as proven easing of headache, giddiness and fatigue like symptoms are a testimony of how detoxification and oral therapy can collaborate together (27).

***Basti Karma, Virechana* and Shamana therapy**

The study was comparative and clinical trial in nature, as there was efficacy testing of *Virechana Karma* (therapeutic purgation) and *Basti Karma* (medicated enema), in combination with *Shamana* therapy. *Basti* and *Virechana* group showed a significant decrease in blood pressure (29.41 and 43.75 respectively). Moreover, associated symptoms heaviness, irritation and difficulty with sleep improved in both the groups (28)

Lifestyle modifications

***Yoga* and meditation**

An earlier study has indicated that *Yoga* with meditation has a role to play in the management of HBP. A reduction in both diastolic blood pressure and systolic blood pressure levels is observed in individuals applying such techniques as *Yoga Nidra* and *Om* chanting as those strategies help to control elevated blood pressure (*Anjana et* al. 2022). In a similar study, *Hadaye et* al. (2021) found that regular yoga practices helped in the better maintenance of blood pressure paving way to stress relief as a strategy of dealing with hypertension (29,30).

***Pranayama* (Breathing Techniques)**

There are breathing regulation practices, namely *Bhramari* (the bee breath) and *Nadishodhana* (the alternate nostril breathing) which proved to lower the blood levels. According to *Upadhyay e*t al. (2023), the levels of blood pressure reduced significantly in individuals that regularly practised these *pranayama* exercises. The revealed evidence indicates that such methods could be used to facilitate the management of hypertension by inducing relaxation and improving heart rate variability (31,32).

Other Therapies

Talahridaya Marma therapy have revealed their effect to the normalisation of elevated blood pressures levels in other therapies. According to *Gautam et* al. (2021), a Case study the authors observed that this technique prevented the rise in high blood pressure measurements, which points to its utility in treating hypertension (33).

Dietary Modifications

Creating mindful modifications to diet has been variously found to assist in minimising high blood pressure. Nutrient packing diet and low salt intake as in DASH diet have been demonstrated to be beneficial in this aspect and is found to be akin to ayurvedic dietary restrictions. According to the studies by *Paula et* al. (2015) and *Chiu et* al. (2016), people who adhered to the given dietary patterns demonstrated significant improvement in blood pressure rates. These findings contribute to the notion that diet is also important in the treatment of hypertension, especially when used together with whole-body mechanisms such as *Ayurveda* (34, 35)

Multifactorial Lifestyle Interventions

MEDICHY study *(Unda Villafuerte at al. 2020)* showed how a well-balanced lifestyle, comprising regular physical activities, dietary changes and routine blood pressure check-ups, can make a real difference in managing high blood pressure. These results underline the fact that a combination of approaches, rather than relying on a single intervention, is needed when addressing hypertension (36)

This evidences points to the strong value of lifestyle changes, particularly those inspired by *Ayurvedic* practices in managing hypertension incorporating *yoga*, *Ayurvedic* therapies and herbal remedies along with sensible changes in diet has been shown nth help reduce blood pressure and improve overall health.

Discussion

Findings of this review underline significant promise of Ayurvedic methods along with lifestyle changes, *Yoga* practices and dietary changes in managing hypertension. From herbal remedies to *panchakarma* therapies to lifestyle modifications, each approach offers its own way of supporting blood pressure control. Together they reflect *Ayurveda's* comprehensive and holistic view of treating hypertension not just physical condition but as one influenced by multiple aspects of health.

Herbal Preparations

A large number of studies back potency of *Ayurvedic* herb-based combination in the control of high blood pressure. These medicines can ascribe their success to strong bioactive compounds contained in herbs such as M-*Sarpagandha Mishra, Sarpagandha Ghana Vati* and *Raktachap Har Yoga* all of which have been demonstrated to decrease systolic blood pressure as well as diastolic blood pressure to a considerable extent. One of its major constituents, *Sarpagandha*(*Rauvolfia serpentina*) has an alkaloid reserpine which act on lowing blood pressure by reducing level of norepinephrine and relaxing the hyperactive sympathetic nervous system. Other herbs that see frequent additions to these formulations such as *Shankhapushpi* and *Jatamansi* play a part in blood pressure control in the form of their tranquilizing and vasodilating properties that ease vascular resistance. The herbal combination also aids in the reduction of anxiety and can help with restful sleep which are two factors that can predispose high blood pressure. The effect of these herbs are therapeutic in a variety of ways based on regulation of autonomic nervous system, inhibition of oxidative stress and endothelial functions. The positive note here is that most studies showed little or no side effects, indicating that herbal solutions can be easily accommodated with conventional hypertension medication (18-19).

External modalities, *Panchakarma*

It has been demonstrated in many studies that *Panchakarma* therapies, especially *Basti*, *Virechana* and external treatment such as *Shirodhara* can be useful in the management of hypertension. All these modalities are meant to restore optimal physiological functioning to balance *doshas* (bodily humors) and to detoxify. *Shirodhara* in particular is reputed to balance the nervous system inducing the state of deep relaxation and lessening the stress. It has been found to reduce both systolic and diastolic blood pressure, possibly promoting parasympathetic functioning to counter overuse of sympathetic nervous system, increasing blood circulation (26).

Virechana and *basti* are supposed to have direct influence on eliminating toxins and diminishing inflammation, which decrease blood pressure. Both of which lead to reduction of the blood pressure. The potential of therapies to reduce the burden of hypertension through alleviation of capillary stasis, decrease in excessive fluid retention and improve metabolic activity and thereby reduce blood pressure are reported in some studies of the therapy. This is further supplemented by the use of internal medicines able to maintain the cardiovascular health after Panchakarma and halt recurrence of hypertension (27,28).

Such therapeutic properties are based on the main points of *Ayurveda*, that postulate the importance of detoxification and restoration of balance in the body. Covering both the physiological and subtle components of the disease, *Panchakarma* modalities offer a wholesome solution to the high blood pressure that is not confined in symptomatic relief of the condition but also restoration of the long term health.

Lifestyle Modifications

Lifestyle modifications, an important element of *Ayurveda* treatment have proved to be rather effective in treatment of hypertension especially when used in conjunction with changes in diet and *yoga*. Research that demonstrates that *Om* chanting and *Yoga nidra* diminishes blood pressure. Such techniques are likely to be effective because they reduce their stress level, trigger a parasympathetic response, which lowers the blood pressure, and eases sympathetic hyperactivity. The benefits of these practices are a calming effect on overall well being and enhancement of cardiovascular health. [29,30]

Pranayama techniques that is capable of regulating the autonomics nervous system, including *Nadishodhana* and *Bhramari* are especially effective in disposing of high blood pressure. Because it helps kill stress, reduces heart rate, and enhances heart rate variability, these breathing methods help to reduce blood pressure to normal. The *Pranayama* evens the hypophysiological activities that control blood pressure such as boosting of importance and reducing any stress (31,32).

Indicative dietary approaches have also been shown as a necessary means of control over HTN, specifically the restriction of salt and promoting more potassium rich foods. *Ayurveda* dietary principles are largely emphasised in DASH diet which has been found to reduce blood pressure significantly by curbing the amount of fluid retained as well as improving ventilation of blood vessels. Fruits and vegetables, whole grain and low-fat dairy products will promote vascular health by containing such nutrients as potassium, magnesium and calcium etc., whereas the intake of saturated fat and sodium will be reduced. Reducing the sodium intake also decreases blood pressure by eliminating rise of water retention but when implemented together with DASH diet, the effect is even greater when it helps to decrease more than 20 mmHg in those with a SBP of over 150 mmHg. This may be of synergistic benefit comparable to the efficacy of antihypertensive medications, in that diet is noted as a very important aspect of hypertension management. This is indicative of the fact that diet is a pillar towards lowering blood pressure (34,35).

A multifaceted approach that integrates lifestyle changes including *yoga* practices and diet along with *Ayurveda* therapies and herbo-mineral preparations has been proven to be highly effective in hypertension control.

Conclusion

Ayurveda is a comprehensive approach to the management of hypertension treating its causes with the help of herbs, *Panchakarma* and alteration of life style. In this review, there is a special focus on multi-faceted interventions, particularly bio-purifications methods, such as *Virechana* and *Basti*, external applications, *Shirodhara* and herbs/herbo-mineral preparations along with some dietary modification and yoga practices on the management of hypertension. Although promising outcomes can be observed, available clinical evidence has been limited by the small samples sizes, methodological diversity and lack of follow-up. To strengthen the foundation of evidence, there is a necessity to thoroughly carry out randomized controlled trials with sound designs sufficiently large sample sizes using validated means of outcome and cardiovascular parameters. The psychophysiological processes behind *Ayurvedic* practises and their effects in long-term cardiovascular outcomes should also be inspected in future studies. An enhanced combination of Ayurveda and current research strategies may follow at the end of a successful long-term management of hypertension.

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