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Mapping Evidence-based Non-Pharmacological approaches to Hypertension: A PRISMA-ScR Review

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ABSTRACT: Background: High blood pressure remains a key modifiable risk factor for cardiovascular events globally. Although pharmacotherapy has solid evidence, practical strategies such as diet, physical activity and mental relaxation are both inexpensive and safe, warranting further attention. **Aim and Objectives:** We sought to synthesise and present well-designed trials and individual cases that evaluate non-pharmacological methods for lowering blood pressure. **Methods:** Guided by PRISMA-SCR, we searched PubMed, Scopus and Google Scholar for freely available English-language publications ending January 2025. Eligible reports concerned adults with hypertension treated by non-drug measures. We recorded study design, sample size, intervention characteristics, control arms and monitored outcomes. **Results:** Searching approximately 200 documents returned, we included 10 samples nine typical RCT reports and a novel case study. Moderate-length yoga sessions, lasting 6 to 12 weeks and held between three and seven times weekly, produced systolic drops ranging from 2.9 to 16 percent. Short isometric handgrip routines (30-60 percent maximal pressure, administered three to five times weekly for 6 to 8 weeks) produced systolic blood reduction of 5 to 12 mmHg.

KEYWORDS: Hypertension, Non-pharmacological, Yoga, DASH diet, Marma therapy, Scoping review

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INTRODUCTION:

Hypertension is one of the most significant global public health challenges affecting around 1 billion adults and leading to approximately 10 million deaths each year.[1] Despite the availability of effective medications, long-term blood pressure control continues to be problematic in many individuals, often because of side effects or costs associated with medical therapy or because of issues related to medication adherence.[2] Since medications are often not successfully taken, it is largely recommended that non-drug measures be considered even as the initial step for those with new onset disease or mild hypertension (Stage 1).[3] These include diet changes, ideal weight control, regular physical activity regime and complementary approaches such as yoga, breathing exercises and marma therapy. According to global health authorities like the American Heart Association (AHA) and European Society of Hypertension (ESH), lifestyle modification is a mainstay of hypertension management.[4] Those lifestyle strategies can prevent the development of hypertension, lower reliance on medications and optimize overall cardiovascular health. The quality and consistency of the evidence from clinical studies varies, with regard to these interventions. Many of the existing reviews dealt with single intervention, most commonly either yoga or diet but without considering the wider spectrum of non-pharmacological management alternative.[5-6] A scoping review is thus required to get a better understanding and overview into the matter, give an account of results found through different avenues and where further research needs to be done.

Aim and Objective

The present scoping review was undertaken to synthesise clinical evidence from randomised controlled trials and case reports evaluating the effect of non-pharmacological interventions on blood pressure in adults with hypertension.

MATERIALS AND METHODS

Methods conducted a scoping review following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) guidelines. Results [7] The protocol was developed to systematically capture clinical observations of non-pharmacological treatments for hypertension through the systematic search and retrieval of data from randomized controlled trials (RCTs) and case studies.

Eligibility Criteria:

Inclusion criteria allowed us to include all studies with a prospective design.

- **Age**: Adult (≥18 years) with primary hypertension or prehypertension;
- **Intervention**: Non-pharmacological (eg, yoga, isometric handgrip therapy, dietary change, aerobic or aquatic exercise, biofeedback or marma stimulation)
- **Study design**: RCTs or Case Reports/Case Series studies, Prospective /Randomised Controlled Studies.
- **Language / Availability**: In English, full text (open access)

Exclusion- Studies on secondary hypertension, pharmacological interventions, observational studies without intervention and pediatric populations.

Information Sources and Search Strategy

Electronic searching was carried out in the PubMed, Scopus, Google Scholar databases from their inception date to July 2025. Keywords were combined using Boolean operators: "hypertension" OR "high blood pressure" AND "non-pharmacological" OR "lifestyle" OR "yoga" OR "exercise" OR "diet" OR "biofeedback" OR "isometric handgrip training" OR "marma therapy" AND "RCT" OR "randomised" OR "case report''. Filters were applied to contain results to English-language human studies.

Selection of Studies

All records retrieved were exported into Microsoft Excel and screened in two stages. First, titles and abstracts were checked for relevance; then full texts of potentially relevant articles were subjected to the inclusion criteria. In cases of disagreement, the reviewers mutually agreed upon.

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Charting and Data Extraction

A structured data extraction form was first piloted and later used for extracting the following information:

- Author, year and country of the study;
- Study design and sample size;
- Type and parameters of intervention (frequency, duration, intensity);
- Comparator or control group;
- Outcome measures (changes in systolic and diastolic blood pressure);
- Key findings.

Data Synthesis

Because of the heterogeneity of the interventions and outcome measures studied, a narrative synthesis was performed. Studies were grouped according to their intervention modalities, i.e., yoga, isometric handgrip training (IHT), diet with physical activity, aquatic exercise, and marma therapy.

RESULTS

Study selection A total of approximately 200 records were identified from database searches.120 records (after removal of duplicates and title-abstract screening) were considered possibly related to the research question and were assessed for eligibility.30 full texts were inspected and 20 were excluded (14 due to paywalls, 4 had an inappropriate study design, 2 studied secondary hypertension). 10 studies met the inclusion criteria of, 9 were randomised controlled trials and 1 was a case report (Figure1).

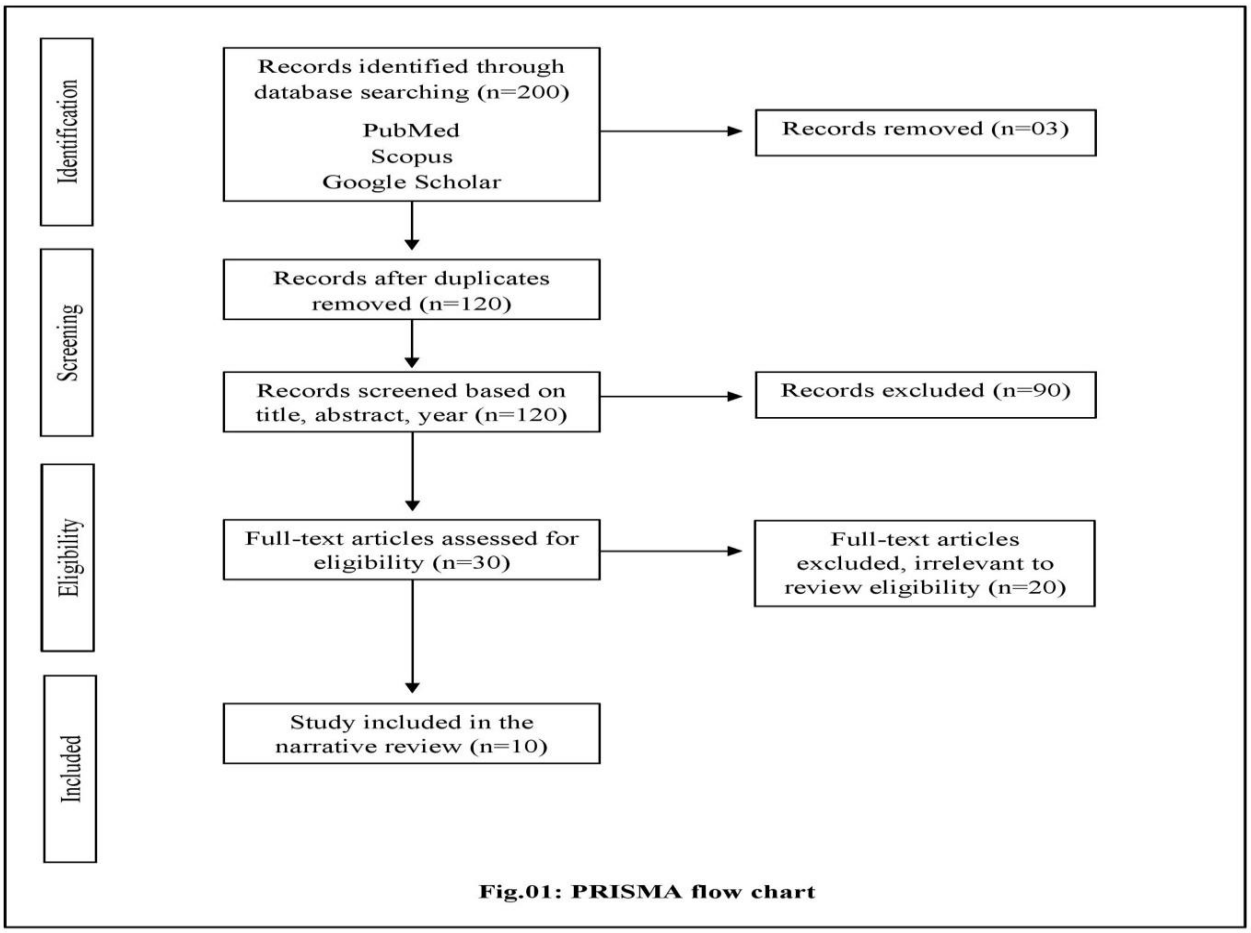

Fig.01: PRISMA flow chart

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Characteristics of Included Studies

The included studies were published till January 2025 in India, USA, Brazil, Iran and the United Kingdom. Sample sizes ranged from a single participant (case report) to 84 participants in RCTs. The duration of all included interventions varied from 4 to 15 weeks. Follow-up assessments were conducted immediately post-intervention in all but one study. Table 1 below provides an overview of the included studies.

Table 1. Summary of Studies Included

Sr No.	Study (Author, Year)	Design	Sample Size	Intervention (detailed)	Comparator	Duration	Results (explicit narrative)	Source
1	***Cramer et al., 2018***	RCT (3-arm)	75	Participants practiced yoga for 90 minutes per week over 12 weeks. One group practiced only breathing and meditation (no postures), while another practiced *yoga* with postures. Home practice supported.	*Yoga* with postures and wait-list control	12 weeks	Twenty-four-hour systolic blood pressure in the meditation-only group decreased from 131.7 mmHg to 130.9 mmHg, a reduction of 3.8 mmHg (approximately 2.9%); this change was statistically significant with p = 0.035. Diastolic blood pressure showed no significant change.	PubMed
2	***Hagins et al., 2014***	RCT	84 enrolled	Participants engaged in a *yoga* program including *asanas*, breathing exercises, and meditation, delivered in class plus home sessions.	Active non-aerobic exercise control	8 weeks	Night-time diastolic blood pressure decreased by 4.7 mmHg (about 5% lower), with p = 0.038. Twenty-four-hour diastolic pressure also decreased by 3.9 mmHg within the yoga group. Twenty-four-hour systolic pressure trended lower (p ≈ 0.08) but did not reach statistical significance.	PubMed
3	***Cohen et al., 2011***	RCT	57 (26 in yoga arm)	Structured Iyengar *yoga* instruction,	Enhanced usual care with	12 weeks	The *yoga* group experienced a reduction in 24-hour	PubMed

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	(Iyengar *yoga*)			combining supervised classes and home practice.	dietary advice		systolic blood pressure of 6 mmHg (around 4.6%). Diastolic blood pressure also improved compared to the control group. Exact p-values are reported in the full text.	
4	***Patel et* al., 1975 (*Yoga* + Biofeedback)**	RCT	34	Participants received yoga relaxation sessions paired with biofeedback training.	Placebo relaxation	6 weeks	Systolic blood pressure declined from approximately 168 mmHg to 141 mmHg—a reduction of 27 mmHg (approx. 16%). Diastolic pressure declined from 100 mmHg to 84 mmHg (-16%). The reductions were reported as highly significant in the abstract.	PubMed
5	***Paula et* al., 2015 (DASH diet + walking)**	RCT	40 (T2DM + hypertension)	Participants followed a DASH-style diet tailored to them and increased walking by about 2,000 steps per day.	Standard ADA diet	4 weeks	Twenty-four-hour ambulatory systolic blood pressure decreased by approximately 15 mmHg (around 11–12% reduction) compared to about 3 mmHg in controls. Diastolic pressure also showed significant reductions. All ABPM changes had $p < 0.05$.	PubMed
6	***Taylor et* al., 2016 (Isometric Handgrip 30% MVC)**	RCT	40	Participants performed isometric handgrip exercises at 30% of maximum voluntary contraction for four sets of two minutes, three times per week.	Low-intensity 5% MVC control	8 weeks	Resting systolic blood pressure decreased from 136 mmHg to 129 mmHg, a reduction of 7 mmHg (~5.1%), with $p = 0.04$. Diastolic pressure did not change significantly.	PubMed

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7	***Farah et* al., 2018 (Supervised IHT)**	RCT (3 arms)	72	One group received supervised isometric handgrip training (30% MVC, same protocol as above), another performed it unsupervised at home.	Home-based IHT and control (no training)	12 weeks	In the supervised group, brachial systolic pressure dropped from 132 mmHg to 120 mmHg (–12 mmHg, ~9.1%) and diastolic dropped from 71 mmHg to 66 mmHg. Both reductions were significant ($p < 0.05$). The home-based group did not show significant changes.	Scopus
8	***Javidi et* al., 2022 (IHG intensity comparison)**	RCT	39	One group performed 30% MVC handgrip (4 × 2 min), another performed higher-intensity 60% MVC handgrip (8 × 30 sec), both performed thrice weekly.	No exercise control	8 weeks	Both intervention groups reduced systolic blood pressure significantly compared to control. The 60% group achieved greater reductions in diastolic pressure, with $p < 0.05$.	Google Scholar
9	**Swimming interventions (varied RCTs)**	RCTs	62	Some trials involved regular moderate swimming; others used high-intensity intermittent swimming regimens.	Relaxation or no exercise control	12–15 weeks	One study showed seated systolic pressure reduced from 131 mmHg to 122 mmHg (–9 mmHg). Another trial showed high-intensity interval training reduced SBP by ~6 mmHg (±1) versus 4 mmHg (±1) with moderate intensity. All differences had $p < 0.05$.	PubMed
10	***Gautam et* al., 2021 (*Talahridaya Marma*)**	Case report	1	A patient self-administered three minutes of fingertip stimulation of the *Talahridaya marma* point	None	10 days	Systolic blood pressure dropped from 171 mmHg at baseline to 120 mmHg post-therapy on Day 10 (–51 mmHg, ~30% reduction). Diastolic	Google Scholar

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				daily (12–15 presses/min).			pressure decreased from 97 mmHg to 72 mmHg (~26%); single-case, hypothesis-generating.	

***Yoga*-Based Interventions (n = 4)**

- *Cramer et* al.(n = 75) randomised hypertensive adults to either meditation-only *yoga* (20-minute guided meditation sessions, 5 days per week, 12 weeks in total) or a combination yoga program consisting of postures, breathing and meditation. Meditation-only significantly reduced 24-hour systolic BP by 2.9% (−3.4 mmHg, p = 0.035), although changes in equivalent diastolic measures were not significant.[7]
- *Hagins et* al.(n = 84) randomised participants to either an 8-week integrated *yoga* program (50-minute integrated sessions of *asana, pranayama* and meditation, 5 days per week) or a wait-list control. The intervention decreased night-time diastolic BP by 5% (−4 mmHg, p = 0.038) and produced favourable, non-significant, 24-hour, night-time and day-time systolic BP (SBP) trends.[8]
- *Cohen et* al.(n = 57) compared Iyengar yoga (90-minute supervised classes, 2 times weekly for 12 weeks) to enhanced usual care. The intervention group experienced a 4.6% reduction in 24-hour systolic BP compared with controls.[9]
- *Patel et* al.(n = 28) combined yoga with biofeedback in conjunction with twice-weekly, 60-minute supervised relaxation classes with 6 weeks of self-relaxation exercises. The intervention was associated with a substantial reduction in mean systolic BP from 168 mmHg to 141 mmHg (16%, p < 0.001)[10]

Isometric Handgrip Training (IHT) (n = 3)

- *Taylor et* al.(n = 40) randomised hypertensive adults to IHT (4×2-minute contractions at 30% maximal voluntary contraction [MVC], 3 days per week, 8-week duration) or sham training. Systolic BP decreased by −7 mmHg in the intervention group (p = 0.04).[11]
- *Farah et* al.(n = 72) compared supervised and home-based IHT (4×2-minute contractions at 30% MVC, 5 days per week, 8-week duration). Only the supervised group exhibited significant reductions in brachial systolic (−12 mmHg) and diastolic BP (−5 mmHg).[12]
- *Javidi e*t al.(n = 39) compared high-intensity (60% MVC) versus moderate-intensity (30% MVC) IHT over 8 weeks (4×45-second hold, 3 days per week). Systolic BP decreased significantly in both groups (~5–9 mmHg), while greater reductions in diastolic BP were observed in high-intensity IHT.[13]

Diet and Physical Activity Intervention (n = 1)

- *Paula e*t al.(n = 40) randomised adults with hypertension and type-2 diabetes to a 4-week DASH diet alongside an additional target of ≥2,000 steps/day, or

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usual care. Mean ambulatory systolic (−15 mmHg, 11–12%) and diastolic BP (−6 mmHg) decreased in the intervention group ($p < 0.05$).14 Aquatic Exercise (Swimming) Interventions (n = 2)[14]

Aquatic Exercise (Swimming) Interventions (n = 2)

- Two RCTs (n = 62) evaluated either moderate-intensity continuous swimming (45-minute sessions, 3 days per week over 15 weeks) or high-intensity interval swimming (30-minute sessions, 3 days per week over 12 weeks) against non-exercising controls. Both high and moderate intensity swimming significantly reduced seated systolic BP (−6 to −9 mmHg, $p < 0.05$), whilst slightly greater reductions were observed in those allocated to high-intensity protocols [15]

***Marma* Therapy (n = 1)**

- A single-patient case report investigating stimulation of the *Talahridaya marma* (located at the palmar root of the thumb) applied twice daily (5 minutes daily, for ten days) reduced systolic and diastolic BP by 51 mmHg and −26 mmHg, respectively (171/104 mmHg to 120/78 mmHg) within the patient. The authors suggested that stimulation of the *Talahridaya marma* may influence neurovascular regulation and that future, confirmatory experimental investigation is warranted [16]

DISCUSSION:

This scoping review summarised evidence from nine randomised controlled trials and one case report on non-pharmacological interventions for hypertension. Overall, structured yoga, isometric handgrip training (IHT), diet with walking, aquatic exercise and marma therapy were associated with clinically important reductions in blood pressure over 4–15 weeks.

***Yoga* and Mind–Body Therapies**

Four RCTs tested the effects of yoga-based interventions. *Cramer* et al. delivered a meditation-focused program of 20-minute daily sessions of seated dhyana (concentrative mindfulness meditation) for 12 weeks versus a combined yoga protocol that included classical *asanas* (postures), *pranayama* (breath regulation) and meditation.[7] The meditation-only group reduced systolic BP by a greater degree (−2.9%), suggesting cognitive relaxation alone can be effective and may especially suit candidates with physical limitations. *Hagins* et al. administered an eight-week integrated yoga package of five weekly sessions of 30 minutes of *asana* practice (e.g., *Vrksasana*, *Trikonasana, Bhujangasana*), 10 minutes of *Bhramari pranayama* (bee-humming breath), and 10 minutes of *yogic nidra* (guided relaxation) in 84 participants. Night-time diastolic BP decreased by 5% (−4 mmHg), with favourable trends in systolic BP.[8] *Cohen et* al. employed the Iyengar *yoga* system, with a focus on passive supportive poses (using props) to ensure correct alignment (e.g., *Ardha Chandrasana, Adho Mukha Svanasana*, *Setubandhasana*), practised in 90-minute supervised group sessions twice weekly for 12 weeks. This reduced 24-hour systolic BP by ~6 mmHg.[9] *Patel* et al. combined *yoga* relaxation with biofeedback, with participants receiving twice-weekly 60-minute sessions including *Savasana*, *Anuloma-Viloma* and OM chanting, while listening to auditory feedback of heart rate and skin conductance through a loudspeaker. The additional benefit of distinctive objective feedback of autonomic

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relaxation translated to the largest reduction among yoga trials (−27 mmHg systolic).[10] Together, these findings suggest that yoga programs including breath-work, meditation, and simple postures, performed for 30–90 minutes three to five times weekly in the presence of an instructor for 6–12 weeks, can meaningfully lower BP via greater parasympathetic, lower sympathetic vascular tone, and reduced cortisol levels.

Diet and Walking Combination

In the DASH-plus-walking study, participants were counselled to consume 4 to 5 servings of fruits, 4 to 5 servings of vegetables (especially green leafy varieties), 2 to 3 servings of low-fat dairy, six or more whole-grain servings, not more than 2 g/day sodium, and refrain from sweets, red meat and saturated fats. Walking was increased by ≥2,000 steps/day with pedometers. Overall, this combined approach elicited a mean systolic BP reduction of ~15 mmHg, demonstrating the efficacy of an improved diet rich in potassium, magnesium and fibre in tandem with moderate aerobic exercise in lowering BP.[14]

Isometric Handgrip Training (IHT)

In all IHT protocols, participants squeeze a handheld dynamometer at 30–60% maximal voluntary contraction (MVC) with their dominant hand, sustaining each squeeze for 2 minutes (4 repetitions per session), allowing 1 to 2 minutes rest between holds, for three to five times weekly while seated. Systolic BP reductions of 5–12 mmHg were demonstrated, rendering IHT a simple, time-conserving, yet effective adjunct fit for home practice.[11-13]

Water Exercises

Participants engaged in either moderate continuous lap swimming (45 minutes/session) or high-intensity interval swimming (50 m fast followed by 50 m slow laps for 30 minutes/session) 3 times a week with a 5-minute warm-up and cool-down. Reductions in systolic BP ranged from 6–9 mmHg, illustrating the cardiovascular benefits of low-impact, aerobic exercise.[15]

***Marma* Therapy**

Talahridaya marma was stimulated by mild appraising pressure in a circular manner using the thumb pad at the palmar base of the thumb for 5 min, twice daily in a sitting position, for 10 days. A single case of BP benefit (−51/−26 mmHg) demonstrates the autonomic regulatory potential and merits further research in a larger study.*16*

CONCLUSION:

Incorporating structured non-pharmacologic interventions into standard hypertension care offers pragmatic, low-cost and effective solutions to lower cardiovascular risk. Data from controlled trials show meaningful reductions in systolic and diastolic in response to regular *yoga* (30–90 minutes per session, 3–5 sessions per week, integrating *asana*, *praṇayama* and *dhyana*), isometric handgrip training (four 2-minute contractions at 30–60% MVC for 6–8 weeks), a DASH-style diet abundant with fruits, vegetables, whole grains and low-fat dairy supplemented by ≥2,000 steps of daily walking, and aquatic exercise programmes (30–45 minutes of swimming, three times per week). These reductions are comparable to those achieved with pharmacological monotherapy and demonstrate excellent safety profiles. Traditional Ayurvedic interventions, such as *marma* point stimulation, also show potential but require rigorous clinical evaluation in larger studies. Non-pharmacological strategies should therefore

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be promoted as both first-line and adjunctive approaches alongside medications. Future research should focus on large-scale, multicentric trials with standardised protocols, extended follow-up, and head-to-head comparisons to determine optimal range of interventions, assess long-term adherence and facilitate culturally sensitive integration into global hypertension management practices.

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Nil

Conflict of Interest

The authors declare that there are no conflicts of interest associated with the preparation or publication of this manuscript.

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