

REVIEW ARTICLE

Yoga-based Interventions for Hypertension: A Preferred Reporting Items for Systematic Reviews and Meta-analyses Extension for Scoping Reviews Guided Scoping Review of Clinical Evidence

Bawadkar Prasad^{1*}, Suketha Kumari², Durge Sushma³, Dhanu S¹

¹Post Graduate Scholar, Department of Kayachikitsa, KLE Academy of Higher Education and Research, Deemed to be University, Shri BMK Ayurveda Mahavidyalaya, Belagavi, Karnataka, India.

²Associate Professor, Department of Kayachikitsa, KLE Academy of Higher Education and Research, Deemed to be University, Shri BMK Ayurveda Mahavidyalaya, Belagavi, Karnataka, India.

³Post Graduate Scholar, Department of Swasthavritta and Yoga, KLE Academy of Higher Education and Research, Deemed to be University, Shri BMK Ayurveda Mahavidyalaya, Belagavi, Karnataka, India.

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ABSTRACT

Background: Hypertension is now a global public health issue and a primary contributor to morbidity and mortality. As complementary non-pharmacological interventions such as *yoga* are increasingly used to help control blood pressure, evidence is sparse and scattered.

Objectives: The objective is to identify systematically, map existing clinical research on *yoga*-based interventions for hypertension, and identify evidence gaps through a scoping review.

Methods: The present review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews guidelines. A comprehensive search was carried out across PubMed, Scopus, and Google Scholar databases to identify relevant studies published between January 2015 and January 2025. Eligible studies included randomized controlled trials (RCTs), case studies, and case series that reported *yoga* interventions for hypertension with blood pressure outcomes. 10 eligible studies were included and analyzed.

Results: Eight RCTs, a case study, and a case series met the inclusion criteria. The different types of intervention studied were *pranayama*, *asanas*, *Yoga Nidra*, and integrative approaches combining *yoga* with naturopathy. Majority of studies reported statistically significant reduction in both systolic and diastolic blood pressure. Out of these interventions, *sheetali pranayama* and *bhramari pranayama* were most utilized. Notably, no significant adverse events were reported.

Conclusion: *Yoga* may serve as an effective and safe adjuvant therapy for individuals with hypertension. However, the heterogeneity and poor standardization of methodologies and the lack of long-term follow-up suggest that further standardization and high-quality trials are required.

1. INTRODUCTION

High blood pressure, also known as hypertension is a major contributor to the development of cardiac diseases, related complications, and early

death around the world. Hypertension affects about 1.28 billion adults between the ages of 30 and 79 years, and almost two-thirds of them live in low- and middle-income countries.^[1] Antihypertensive medications are effective, but treatment gaps remain because of a lack of adherence, lifestyle, and large side effects.^[2] As a result, more and more people are looking into complementary and alternative therapies, especially *yoga*, to help them deal with high blood pressure. *Yoga* is an ancient Indian practice that combines *asanas* (physical poses), *pranayama* (breath control), and meditation. It is known to affect autonomic function,

Corresponding Author:

Bawadkar Prasad, Post Graduate Scholar,
Department of Kayachikitsa, KLE Academy of Higher Education
and Research, Deemed to be University, Shri BMK Ayurveda
Mahavidyalaya, Belagavi, Karnataka, India.
Email: prasadbawadkar1406@gmail.com

lower sympathetic activity, and boost baroreflex sensitivity, all of which help control blood pressure.^[3,4] Numerous clinical studies have evaluated the effectiveness of yoga in lowering blood pressure, with frequently encouraging findings.^[5,6] However, these findings may not be widely generalizable due to variations in study design, participant types, *yoga* techniques, and intervention durations. Scoping reviews help examine a range of emerging evidence because they seek to methodically describe the breadth and depth of research on a particular topic.^[7] The goal of this review is to find, characterize, and compile clinical studies that assess *yoga* interventions for high blood pressure patients, identify recurring themes and identify areas that require further investigation to inform future research.

2. METHODS

2.1. Study Design

The scoping review framework, initially put forth by *Arksey* and *O'Malley* and subsequently improved by *Levac* and others, was employed in this review. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) guidelines were adhered to during the reporting process.

2.2. Objective

The objective is to identify, map, and describe the extent and nature of clinical research evaluating yoga-based interventions for the management of hypertension.

2.3. PCC Framework

- Population (P): Adults with hypertension or pre-hypertension
- Concept (C): *Yoga*-based interventions
- Context (C): Clinical settings (hospital, community, or residential).

2.4. Eligibility Criteria

2.4.1. Inclusion criteria

- Study types: Randomized controlled trials (RCTs), case series, and case reports are examples of clinical research
- Participants: Adults with pre-hypertension or hypertension diagnoses
- Intervention: Research where *yoga* serves as the primary therapeutic modality
- Results: Systolic and/or diastolic blood pressure (SBP/DBP) information must be included in reports
- Publication requirements: English-language articles released between January 2015 and January 2025.

2.4.2. Exclusion criteria

- Types of studies: Narrative reviews, editorial opinions, meta-analyses, and systematic reviews
- Study subjects: Studies using laboratory-based models or animals
- Intervention/outcomes: Research that does not outline a formal *yoga* intervention or report blood pressure-related outcomes.

2.5. Search Method

Three electronic databases, PubMed, Scopus, and Google Scholar, were searched extensively for relevant literature. The following keyword combinations were included in the search: “*yoga*,” “*asana*,” “*pranayama*,” “meditation,” “hypertension,” “blood pressure,” “RCT,” “case study,” and “case series.” January 2025 saw an update to the final search. All duplicate records discovered in the databases were manually filtered out.

2.6. Study Selection and Data Charting

Using database searches, researchers first found 122 records. There were 110 unique records left after duplicates were eliminated. 90 articles were excluded based on their relevance after titles and abstracts were screened. After that, researchers evaluated 20 studies complete texts to determine their eligibility. Four of these full texts were eliminated because they did not fit the inclusion criteria, and 6 of them were not retrievable. 10 studies remained for the final review [Figure 1].

The team developed a structured extraction form to methodically record significant details from every study to chart the data. This contained the following information: Author, year study was published, sample size and characteristics, type and length of the *yoga* intervention, the reported blood pressure results, study's limitations, and any adverse events that were mentioned.

3. RESULTS

Out of these screenings, 10 studies fulfilled the requirements for this review. These comprised 1 case study, 1 case series, and 8 RCTs. The *yoga* interventions ranged widely, from brief sessions centered around *pranayama* to lengthy programs that integrated *yoga* with naturopathic or dietary modifications. The next section provides a summary of each study. This contains information on the study's design, participant characteristics, intervention and control conditions, intervention duration, key blood pressure outcome measures, and significant findings [Table 1].

3.1. Anjana and Ravikiran (2022)^[8]: *Yoga Nidra* and Om Chanting's impact on Hypertension

Sixty hypertensive patients were randomized to either the intervention group or the control group in this RCT. The intervention group ($n = 30$) participated in *Yoga Nidra* and Om chanting sessions every day. For 2 months, the sessions took place 5 days a week and lasted 30 min each. Standard care without any extra interventions was given to the control group ($n = 30$). The primary outcome measure was blood pressure. Following the intervention, there was a significant decrease of 9.3 mmHg in SBP and 6.2 mmHg in DBP in the *yoga* group, with $P < 0.01$. Strong statistical significance is indicated by this result. No adverse effects were noted.

3.2. Pushpanathan and Govindaraj (2016)^[9]: Integrated *Yoga* Therapy for Essential Hypertension

These RCTs involved 60 patients diagnosed with essential hypertension. The patients were randomly assigned to two groups. The intervention group ($n = 30$) participated in an integrated *yoga* therapy program for 12 weeks. This program included *asanas* (postures), *pranayama* (breathing exercises), Om chanting, and meditation. The control group ($n = 30$) continued with standard medical care without any extra treatment.

Blood pressure readings were taken before and after the intervention. At the end of the 12 weeks, participants in the *yoga* group showed a meaningful reduction in SBP of 7.8 mmHg and DBP of 5.1 mmHg, with $P < 0.01$ compared to the control group. The study found no adverse events, indicating that the intervention was safe and well-tolerated.

3.3. Borah *et al.* (2023)^[10]: *Iyengar Yoga* for pre-hypertension

Participants in a study with 80 pre-hypertensive adults were split into two groups. One group ($n = 40$) engaged in *Yoga*, while the other group

($n = 40$) received no intervention. The *yoga* group used supportive props to work on proper postural alignment over 12 weeks. The primary outcome that was measured was blood pressure. The *yoga* group experienced a statistically significant ($P < 0.01$) decrease in both systolic and DBP, with the former dropping by 6.5 mmHg and 4.4 mmHg, respectively. Moderate participant adherence was noted, and no adverse effects were observed.

3.4. Bhardwaj and Bhardwaj (2020)^[11]: *Sheetali Pranayama*

Fifty people with high blood pressure participated in this uncontrolled study by practicing *Sheetali Pranayama* for 15 min every day for 3 months. Blood pressure readings were taken by researchers both before and after the procedure. Both the diastolic (5.7 mmHg) and systolic (8.4 mmHg) blood pressures significantly decreased, with the results achieving statistical significance ($P < 0.01$). The study demonstrated *Sheetali Pranayama*'s potential efficacy as a high blood pressure management technique even in the absence of a control group.

3.5. Shetty *et al.* (2024)^[12]: *Yoga and Naturopathy Integration*

The effects of a *yoga* and naturopathy program were assessed in a RCT with 108 hypertensive participants. Participants were divided into two equal groups. *Yoga* and naturopathic treatments were part of a 10-day residential program for the intervention group ($n = 54$). They then spent 9 months in a structured home practice. Standard lifestyle modification advice was given to the control group ($n = 54$). Blood pressure reduction was the primary outcome that was measured. SBP dropped by 11.2 mmHg, and DBP dropped by 6.8 mmHg in the intervention group ($P < 0.001$). Out of all the reviewed studies, this one showed the biggest improvement. There were no reported safety concerns, and participant adherence was good.

3.6. Upadhyay and Joshi (2023)^[13]: *Acute Pranayama Effects*

Forty-five hypertensive patients were split into three equal groups for this RCT: 15 *Bhramari Pranayama*, 15 *Nadi Shodhana Pranayama*, and 15 control participants. Every group took part in a single, 20-min session. Before and after the session, researchers took measurements of heart rate variability and blood pressure. Systolic and DBP did not significantly change in any group, according to the results ($P > 0.05$). This suggests that significant cardiovascular effects might not be achieved with a single session.

3.7. Mhatre and Kulkarni (2023)^[14]: *Case Study - Bhramari and Panchakarma*

A 52-year-old patient with stage 1 hypertension was the subject of a single-patient case study. Over the course of 90 days, the treatment combined *Panchakarma* procedures with *Bhramari Pranayama*. Throughout the intervention, blood pressure measurements were made every 2 weeks. The patient's systolic pressure decreased from 142 mmHg to 124 mmHg by the program's conclusion. From 108 mmHg to 80 mmHg, his diastolic pressure dropped. There were no negative effects observed. This case illustrates the potential of integrative approaches to hypertension management, even though these findings cannot be generalized to a larger population.

3.8. Bangalore Yoga Institute (2022)^[15]: *Case Series*

One hundred and four individuals with a diagnosis of hypertension participated in a 21-day residential program that combined *yoga* and a plant-based diet as part of this case series. Along with dietary adjustments, the daily regimen included *yoga* poses, *pranayama*,

and relaxation techniques. Participants experienced a drop in SBP of roughly 10 mmHg and DBP of approximately 5 mmHg on average. Although these findings appear encouraging, the conclusions are undermined by the absence of a control group and long-term follow-up.

3.9. Mani *et al.* (2021)^[16]: *Community Yoga in Nepal*

One hundred and twenty-one adults with high blood pressure participated in a RCTs. Participants were split into two groups: a routine care group ($n = 60$) and a *yoga* group led by a health worker ($n = 61$). After receiving initial instruction, the *yoga* group spent 12 weeks practicing at home. Before and following the intervention, researchers took blood pressure readings. The SBP of 7.66 mmHg and the DBP of 3.86 mmHg were significantly lower in the *yoga* group ($P < 0.001$). These findings demonstrate that community health workers can successfully implement *yoga*-based interventions.

3.10. Bhardwaj and Singh (2020)^[17]: *Self-guided Sheetali Pranayama*

In a RCTs with 100 adults who have hypertension, participants were split into two groups. One group ($n = 50$) practiced *Sheetali Pranayama* for 15 min daily, while the other group ($n = 50$) received no specific intervention. After 3 months, the group practicing the technique showed significant drops in blood pressure. Systolic pressure decreased by 8.2 mmHg, and diastolic pressure dropped by 5.3 mmHg ($P < 0.01$). These results suggest that regular, self-directed practice of breath-based techniques like *Sheetali Pranayama* can help manage blood pressure effectively.

4. DISCUSSION

The present review synthesized evidence from 10 clinical studies assessing the role of *yoga* in managing hypertension, encompassing RCTs, a case series, and a case report. A wide array of *yoga* interventions were evaluated across studies, with considerable variation in design, sample size, and duration. Notably, the review found consistent trends in the type of interventions applied and the nature of blood pressure outcomes reported.

The most often utilized aspect of *yoga* in the reviewed studies was *pranayama*, particularly *Sheetali* and *Bhramari Pranayama*.^[14,17] Numerous interventions involved a combination of *yoga* poses, breathing exercises, meditation, and dietary modifications. Even when participants practiced *Sheetali Pranayama* alone, it consistently reduced blood pressure, making it the most studied technique. Both systolic and DBP were found to be positively impacted by *Bhramari Pranayama* when it was tested as a stand-alone practice and in larger programs.^[17]

In terms of results, systolic and DBP were significantly lowered in eight out of the ten studies that were reviewed. Longer-lasting and multi-component interventions, such as *yoga* and naturopathy, showed the greatest benefits. Shorter interventions, such as the Upadhyay and Joshi single-session *pranayama* study, did not, however, result in appreciable changes. This implies that consistent and rigorous practice might be essential to attaining significant therapeutic benefits.^[13]

In the study by Anjana and Ravikiran *yoga nidra* and om chanting also appeared to help reduce blood pressure.^[8] Changes in the autonomic nervous system's equilibrium and a decrease in stress reactions may be the cause of this effect. Increased parasympathetic activity, decreased sympathetic output, improved endothelial function, and decreased cortisol levels are some of the potential mechanisms that the studies

propose. It is crucial to remember that these physiological factors were only measured directly in a small number of studies, so these mechanisms are currently primarily theoretical.

Although there is evidence that *yoga* can help lower blood pressure, the studies had a number of methodological flaws. Small sample sizes, lack of blinding, brief follow-up times, and variations in *yoga* practices were frequent issues that could affect the validity of the findings. The conclusions are less strong due to the case study and case series' poor statistical support, despite the fact that they provided insightful clinical information.

4.1. Additional Perspective on Patterns and Research Quality

Clinical data from ten studies that investigated *yoga* as a treatment for high blood pressure were collected and analyzed for this review. This comprised one case study, one case series, and eight RCTs. *Yoga pranayama* (such as *Sheetali*, *Bhramari*, and *Nadi Shodhana*), physical postures (such as Iyengar Yoga), and meditation techniques (such as Om chanting and *Yoga Nidra*) were all used in the interventions. Program lengths ranged from single-session interventions to 9-month programs. Crucially, systolic and DBP were significantly lowered in all but one study. According to this research, *yoga* might be a useful non-pharmacological treatment for high blood pressure.

In 7 of the 10 studies that were reviewed, breath regulation techniques or *pranayama* were the most commonly used methods. The most popular of these were *Sheetali* and *Bhramari Pranayama*, which were regularly associated with notable drops in both systolic and DBP. One noteworthy finding is that *pranayama* interventions, whether self-practiced or led by an instructor, produced favorable results. This implies that even when used independently and without constant supervision, breath-based techniques can be beneficial.

Integrative *yoga* programs that combined *asanas*, *pranayama*, chanting, and relaxation techniques were used in several studies. Greater drops in blood pressure were typically associated with these holistic interventions, like those by Shetty *et al.* and Pushpanathan and Govindaraj. The combined advantages of various *yoga* techniques could be the cause of this. Interestingly, the longest programs saw the biggest drops in blood pressure: A 9-month *yoga* program.

The study by Anjana and Ravikiran demonstrated the effectiveness of Om chanting and *Yoga Nidra*. The results demonstrate the beneficial effects of meditative *yoga* on the autonomic nervous system and emotional control. Both of these elements play a significant role in the onset and maintenance of hypertension.

4.2. Limitations and Future Directions

Seven of the eight RCTs that were examined demonstrated a significant drop in blood pressure. Upadhyay and Joshi the lone exception, failed to discover a significant impact. This most likely occurred as a result of the intervention's one-session *yoga* limit. This emphasizes how crucial consistent practice is to getting tangible results. Positive results were also demonstrated by the case series from the Bangalore *Yoga* Institute and the case study by Mhatre and Kulkarni. However, because of their study designs and lack of control groups, their results should be interpreted with caution.

The reviewed studies differed greatly in a number of ways. Sample sizes, control group configurations, adherence tracking, and outcome measurement instruments were among them. Manual blood pressure

readings were used in the majority of studies. Few employed more effective techniques, such as 24-h or ambulatory monitoring. Furthermore, it was rare to evaluate secondary outcomes such as stress levels, quality of life, and physiological indicators such as cortisol or heart rate variability. Because follow-up times were typically brief, it was difficult to determine the long-term viability and efficacy of *yoga*-based therapies for hypertension.

Few studies systematically monitored or documented adverse events, despite the fact that participants generally reported that adherence and safety were satisfactory in the majority of interventions. Nonetheless, the absence of significant adverse effects bolsters the favorable safety record of *yoga*-based treatments for hypertension.

Future research should focus on building a stronger evidence base by using larger and more diverse participant groups, ideally through multisite study designs. Standardising *yoga* protocols is essential. This includes having clear components, frequency, and duration to improve reproducibility. Adding objective physiological measures, such as heart rate variability and inflammatory biomarkers, will give a better understanding of the underlying mechanisms. Researchers should also look at long-term adherence and the sustainability of *yoga* practices. They should evaluate the impact on common comorbid conditions such as diabetes and anxiety. In addition, studies need to examine the acceptability, feasibility, and cost-effectiveness of *yoga* interventions in real-world clinical and community settings.

4.3. For Practice

Yoga seems to be a safe and effective way to help manage high blood pressure. Healthcare providers could think about adding organized *yoga* programs to regular treatment plans, especially for groups that value mind-body practices.

4.4. For Research

Future RCTs should focus on larger sample sizes, use standardized intervention protocols, and assess the long-term sustainability of outcomes. Furthermore, adding *yoga* to public health strategies.

5. CONCLUSION

This review summarizes findings from ten clinical studies examining how *yoga* can help manage hypertension. Most studies showed significant reductions in both systolic and DBP. *Pranayama* and integrated *yoga* programs provided the most consistent benefits. While these results suggest that *yoga* can be a useful non-drug treatment, differences in study methods and short follow-up times weaken the evidence. To prove long-term effectiveness and wider use, future research should center on carefully designed, longer trials involving different groups of people.

6. ACKNOWLEDGMENTS

Nil.

7. AUTHOR'S CONTRIBUTIONS

All authors have contributed equally to conception, design, data collection, analysis, drafting, and final approval of the manuscript.

8. FUNDING

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9. ETHICAL APPROVALS

This study does not require ethical clearance as it is a review article.

10. CONFLICTS OF INTEREST

Nil.

11. DATA AVAILABILITY

This is an original manuscript and all data are available for only review purposes from principal investigators.

12. PUBLISHERS NOTE

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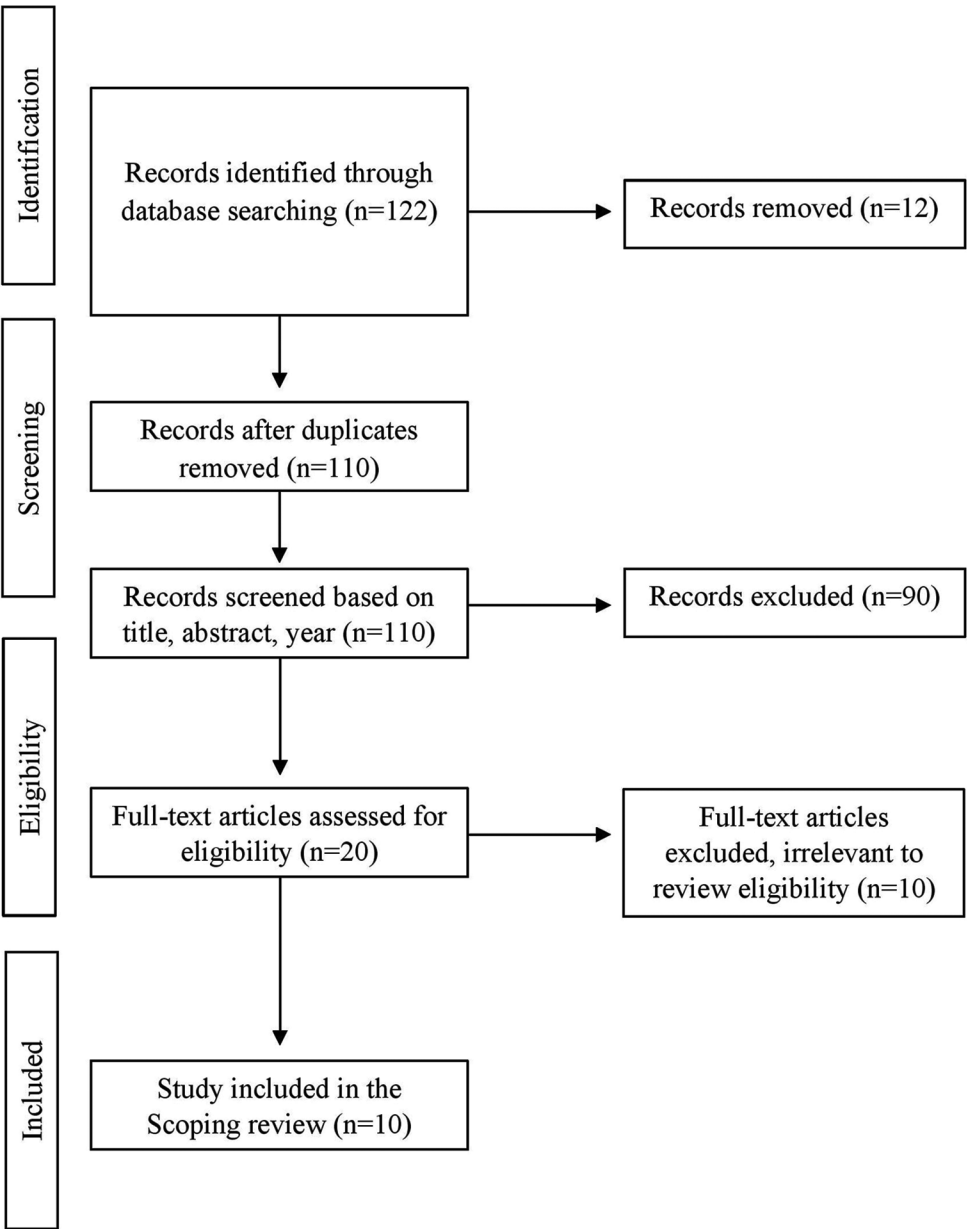


Figure 1: Preferred reporting items for systematic reviews and meta-analyses extension for scoping reviews flowchart

Table 1: Summary of clinical studies on yoga in hypertension

Author (year)	Study type	Sample	Intervention given	Period	Results	Limitations	Adverse events	Indexed in
Anjana and Ravikiran (2022) ^[8]	RCT	60 hypertensive patients, aged 30–60	Intervention group: Om Chanting+Yoga Nidra; control group: Standard care	2 months	Significant reduction in SBP (9.3 mmHg, $P<0.01$) and DBP (6.2 mmHg, $P<0.01$)	Small sample, short-term follow-up	None reported	PubMed, Scopus
Pushpanathan and Govindaraj (2016) ^[9]	RCT	60 essential hypertensives	Intervention group: Integrated Yoga Therapy (Asanas, Pranayama, OM chanting, meditation); Control group: Routine care	12 weeks	Significant reduction in SBP (7.8 mmHg, $P<0.01$) and DBP (5.1 mmHg, $P<0.01$)	Single-center, not long-term	None reported	Scopus, Google scholar
Borah <i>et al.</i> (2023) ^[10]	RCT	80 pre-hypertensive individuals	Intervention group: Iyengar Yoga (standing postures, inversions, Savasana); Control group: No intervention	12 weeks	Significant reduction in SBP (6.5 mmHg, $P<0.01$) and DBP (4.4 mmHg, $P<0.01$)	No follow-up, adherence not assessed	None reported	Scopus, Google Scholar
Bhardwaj and Bhardwaj (2020) ^[11]	RCT	50 hypertensives, aged 35–55	Sheetali Pranayama only (no control group)	3 months	Significant reduction in SBP (8.4 mmHg, $P<0.01$) and DBP (5.7 mmHg, $P<0.01$)	No control group, only pranayama studied	None reported	PubMed, scopus
Shetty <i>et al.</i> (2024) ^[12]	RCT	108 hypertensives	Intervention group: Yoga+Naturopathy; Control group: lifestyle advice	10 days+ 9 months	Significant reduction in SBP (11.2 mmHg, $P<0.001$) and DBP (6.8 mmHg, $P<0.01$)	Self-report bias, no blinding	None reported	PubMed
Upadhyay and Joshi (2023) ^[13]	RCT	45 hypertensives	Nadi Shodhana, Bhramari Pranayama, and Control (no intervention) groups	Single session	No significant change in SBP or DBP in any group ($P>0.05$)	Short-term, no sustained effect	None reported	PubMed, scopus
Mhatre and Kulkarni (2023) ^[14]	Case Study	1 hypertensive patient	Bhramari Pranayama+Ayurvedic Panchakarma	90 days	Reduction in SBP from 142 to 124 mmHg and DBP from 108 to 80 mmHg (descriptive only)	Single-patient report, no statistical analysis	None reported	Scopus
Bangalore Series (Inst.) ^[15]	Case Series	104 hypertensive patients	Residential Yoga+Diet: Asanas, Pranayama, lifestyle counselling	21 days	Approximate reduction in SBP (~10 mmHg) and DBP (~5 mmHg); no statistical data	Institutional data, not peer-reviewed	None reported	Google scholar
Mani <i>et al.</i> (2021) ^[16]	RCT	121 hypertensives (Nepal)	Intervention group: Health worker-led yoga (Asanas, Pranayama, lifestyle); Control group: Routine care	3 months	Significant reduction in SBP (7.66 mmHg, $P<0.001$) and DBP (3.86 mmHg, $P<0.01$)	Non-blinded, self-reported adherence	None reported	PubMed, scopus
Bhardwaj and Singh (2020) ^[17]	RCT	100 hypertensives	Intervention group: Sheetali Pranayama (self-practice); control group: No yoga	3 months	Significant reduction in SBP (8.2 mmHg, $P<0.01$) and DBP (5.3 mmHg, $P<0.05$)	No active control, pranayama-only design	None reported	PubMed, scopus

RCTs: Randomized controlled trials, SBP: Systolic blood pressure, DBP: Diastolic blood pressure