

Role of Asana, Pranayama, and Meditation as an Add-on Therapy in Regulation of Hypertension

Diksha Devi, Sandeep Bhattacharya

Department of Physiology, King George's Medical University, Lucknow, UP, India

ABSTRACT

A common condition that affects the body's arteries and is associated with a higher risk of developing cardiovascular diseases is high blood pressure, also known as hypertension. A sedentary lifestyle, poor diet, obesity, smoking, stress, and a family history of high blood pressure are just a few of the things that can potentially raise your blood pressure. You can effectively manage your blood pressure by maintaining a balanced diet and getting regular exercise. A healthy and alternative approach to controlling and regulating high blood pressure is yoga. Yoga is a historical form of exercise that can help you with various health problems. It has been adapted for alternative therapies and consists mostly of physical postures, breathing techniques, and meditation. This review aims to compile all the literature on the subject. Only the years 2009 to 2023 were searched in the databases Google Scholar, Research Gate, Scopus, and Cochrane. The safety of yoga practice under the guidance of a trained yoga teacher may be generally accepted. However, future research will need to focus on high-quality clinical trials and the mechanism of action of various yoga practices

Keywords: Asana, High blood pressure, Meditation, Mindfulness therapy, Pranayama

doi: 10.61081/htrnj/23v9i403

Introduction

Hypertension is a key risk factor for heart attack and stroke, and it is the third highest cause of death in the United States.¹ High blood pressure is known as the "silent killer" because it frequently has no warning signs or symptoms.² The International Society of Hypertension and the American Society of Hypertension (ISH/ASH) define hypertension into three different phases: pre-hypertension (SBP: 120-139 mmHg, DBP: 80-89 mmHg), stage 1 hypertension (SBP: 140-59 mmHg, DBP: 90-99 mmHg), and stage 2 hypertension (SBP 160, DBP 100 mmHg).³⁻⁴

As hypertension is associated with serious health issues such as cardiovascular disease and kidney disease, it is regarded as a major global danger. Hypertension additionally creates an enormous financial burden, which includes both direct medical expenditures for the management of hypertension and the costs of hypertension-related complications, as well as additional expenses such as diminished productivity caused by absence from the workplace.⁵⁻⁶

During the preceding four decades, the global prevalence of hypertension climbed rapidly. Current estimates place the global prevalence of hypertension at around one billion individuals. If current trends continue, 1.56 billion people over the age of 20 will have hypertension by 2025.⁷⁻¹⁰ According to the World Health Organization (WHO), hypertension is a global health issue that is one of the major causes of mortality. 76.4 million adult Americans suffer from hypertension, which costs the country \$48.6 billion every year. This figure includes the cost of medical care, blood pressure medications, and missed work. The high incidence of uncontrolled hypertension has been related to the high cost of pharmaceuticals and medication non-adherence.^{11,12}

Traditional hypertension therapy techniques include lifestyle adjustments, specifically dietary changes, regular exercise, and alleviating stress, in addition to drug therapy. Existing hypertension therapy efforts have succeeded in significant improvements in hypertension awareness, assessment, and management. However, the WHO (2013) has highlighted the significance of 'thinking outside the box' for new approaches to improve hypertension management.^{13,14}

Corresponding author

Diksha Devi, Department of Physiology, King George's Medical University, Lucknow, UP, India. Email: diksha03031993@gmail.com

Practicing of yoga as a non-pharmacological approach could be a particular extra strategy to improve the treatment of hypertension. Yoga, a traditional Indian philosophy and way of life, was developed in the Indian subcontinent over 5,000 years ago and is now utilized to improve health and well-being.^{15,16} There are various branches of yoga, each with a different emphasis on and strategy to practice; Hatha yoga, an umbrella word covering physically-based yoga styles such as Iyengar, Asthanga, and Vinyasa, is the most generally practiced form.¹⁷

Patanjali defines yoga as having eight components: moral principles (Yama), self-discipline (Niyamas), yogic poses (asana), breathing practices (pranayama), sense withdrawal (Pratyahara), concentration (Dharana), meditation (Dhyana) and relaxation practices, and transcendence (Samadhi).¹⁸⁻²¹ Yoga may be advantageous to hypertension due to its blood pressure-lowering effect, in addition to its effects on physical activity, alleviating stress, and lifestyle.^{22,23} Yoga's accurate process of dropping blood pressure is unknown, but suggested physiological factors include an increase in parasympathetic nerve activity, possibly due to stimulation of the vagal nerves, suppression of the hypothalamic-pituitary-adrenal axis, and a decrease in the sympathetic nervous system's function and reactivity.²⁴⁻²⁶ Yoga, as a form of exercise, can help patients with hypertension meet their prescribed levels of physical activity.²⁷

The goal of this review of literature is to give a summary and evaluation of the prior investigation, as well as to contribute to the amount of information on the use of asana, pranayama, and meditation in managing the symptoms of hypertension.

Search Strategy

From January 2009 to September 2023, a review of the most recent literature was undertaken using electronic databases to find acceptable publications for inclusion. The sources of information utilized were Google Scholar, Research Gate, Medline, and Cochrane. Each database was searched using key terms based on the study question's key factors: The primary words were hypertension, systolic blood pressure, yoga intervention, Asana, Pranayama, Meditation, and quality of life, which were expanded to produce search terms for use across all four sites.

Beneficial Effects Of Yoga On Hypertension

Yoga is a practice that dates back to the Rigveda, which first mentions it as a form of spiritual meditation. The Rigveda describes yoga as a way to increase awareness, increase muscle strength, and promote growth.²⁸ Yoga is a practice that promotes physical, mental, emotional, and spiritual well-being. The practice of yoga is based on the mind-body approach. The fundamentals of yoga are stretching, body postures (asanas), regulating breathing (pranayama) and concentration skills (meditation).²⁹

3.1 Yoga Asana: Yoga asana is a physical activity to keep the body and mind healthy and happy. Yoga brings out the complete energy embodied in a human being, as yoga is performed in coordination with the movement of the body and the movement of the mind.³⁰⁻³¹

i. Matsyendrasana: After seated in vajrasana, stretch both legs

forward on the mat. Fold the right leg below the left thigh, then cross the opposite leg near the right knee. Then, raise your left hand, cross over with your left leg, and grab the right ankle joint.

ii. Ardha Pawanmuktasana: After sitting on the mat, in a position of supine and lift one leg, gently curve the knee and try to contact your chin to the knee joint.

iii. Uttanpadasana: Place yourself supine on the mat then carefully lift both legs straight without folding the knees. Continue normal breathing for 5-10 seconds. Exhale slowly, releasing both legs without folding the knees on a yoga mat.

iv. Marjariasana: After sitting in vajrasana, squat down on the floor with palms between the two knees, arch the spine, and look towards the navel region while inhaling. Make a bend in your spine and glance up while exhaling 5-10 times.

3.2 Pranayama:³² Pranayama, ancient yogic breathing techniques, have been gaining popularity, acceptance, and recognition in scientific fields. According to the Chhandogya Upanishad, Prana refers to subtle inner energy, while Vayu denotes outward gross energy. Yoga states that the subtle body (Pranayama kosha), comprising chakras and nadis that contain prana, nourishes the physical body (Annamaya kosha). This prana initiates the chakras, nourishes tissues and systems, and influences physiological functions in the body.

i. Anulom-Vilom Pranayama:³³ Gently fold your right hand's middle and index fingers closer to your palm. Put the thumb in the right nostril and your ring finger in the opposite nostril. Shut your right nostril with your thumb and inhale gently but deeply with your left nostril until your breathing chambers are full. Concentrate on your breathing. Then, with your ring finger, lock your left nostril and release your thumb. Slowly exhale through the right nostril. Now do it backwards, inhaling through the right nostril and releasing through the left.

ii. Bhramari Pranayama:³⁵ Position yourself in Padmasana or another sitting posture. Close your eyes and take a long, deep breath. Now, using your thumbs, close your ear lids or flaps. Apply extremely gentle pressure to the sides of your nose with your index finger just above your brows and the rest of your fingers over your eyes with your middle fingers. Concentrate your focus now on the space between your brows. Keep your mouth closed and exhale slowly via your nose while generating an Om humming sound. This step should be repeated 5 times.

3.3 Meditation:^{36,37} The term "meditation" encompasses a wide range of practices, such as chanting mantras, mindfulness meditation, metaphysical meditation, and others. Hypertension is often believed to be caused by unhealthy behaviors and heightened sensitivity of the sympathetic nervous system, with stress being a major factor. Meditation provides a remarkable means to mitigate the adverse effects of hypertension.

Technique: Sit in an upright and comfortable position. Gently close your eyes. Inhale deeply and exhale slowly. Gradually scan your body, paying attention to any sensations you may feel. Be aware of any thoughts that come up. If your mind starts to wander, refocus your attention on your breath. When you feel ready, slowly open your eyes.

Table 1: Summary of Interventional Studies showing the impact of Yoga Practices on Hypertension.

S. No.	Author Name	Outcome	Year
1.	Murthy <i>et al.</i> ³⁸	Natural healing and therapeutic yoga can be beneficial alternative methods in treating symptoms of hypertension.	2011
2.	Nejati <i>et al.</i> ³⁹	An approach centered on mindfulness treatment may enhance the lifestyle choices and coping skills of hypertensive patients.	2015
3.	Vungarala Satyanand ⁴⁰	We proposed yoga, changes in behaviour, and changes in eating habits, alcohol and smoking cessation, and dealing with stress as treatments for this condition. This is an inexpensive, non-drug medical care advertised by clinicians for lowering blood pressure.	2016
4.	Chauhan. <i>et al.</i> ⁴¹	This study shows that yogic practice can improve both BMI and blood pressure without the need for medication.	2017
5.	Devi <i>et al.</i> ⁴²	Yoga asana mind-body treatment has been reported to reduce respiration and arterial pressure in moderate hypertension.	2017
6.	Hewett <i>et al.</i> ⁴³	A 16-entire week Bikram yoga curriculum did not affect the high rate power aspect of HRV or any of the other CVD risk variables studied. Minimal compliance, as revealed by post hoc investigations, definitely contributed to the null results.	2017
7.	Dhungana RR ⁴⁴	A basic 3-month yoga programme offered by physicians at healthcare places and combined with residence-based practice is successful in decreasing hypertension patients' blood pressure.	2021
8.	Penrod <i>et al.</i> ⁴⁵	Yoga, as performed by patients in their daily lives, maybe a useful technique to control blood pressure.	2022
9.	Pandey <i>et al.</i> ⁴⁶	Yoga behaviour, as part of a 3-months exercise training programme, was related to higher improvement in resting blood pressure, pulse rate, and Reynolds Risk Index in hypertensive individuals than stretching.	2023
10.	Upadhyay <i>et al.</i> ⁴⁷	This study will look at the effectiveness of the yoga intervention package in reducing arterial hypertension in hypertensive patients.	2023

Discussion

Deep breathing exercises such as pranayama induce a state of relaxation that may reduce vagal activity, which in turn may contribute to a drop in blood pressure.

Lowering vagal tone reduces heartbeat as a result of a shift in sympathetic nerve stimulation also a shift in the vascular system as a result of parasympathetic nerve stimulation.^{48,49}

There is a rise in the functioning of the sympathetic nervous system and hypothalamus pituitary-adrenocortical axis around the time of stressful conditions.⁵⁰⁻⁵² Another cause of blood pressure rise has been identified as stress. Cortisol controls blood pressure by limiting salt retention in the body, and salivary alpha amylase is an indicator for sympathetic nervous system activity.^{53,54} Yoga has a substantial influence on both cortisol levels and salivary alpha amylase levels in one of the included investigations.⁵⁵

The most common asanas were Bhujangasana, Setubandhasana, Padottanasana, Ardha Chandrasana, Tadasana, Shalabhasana, and Shavasana. Shavasana was mostly used for relaxation or as the main asana.^{56,57} On the face of it, there seem to be many positive results when yoga is used in combination with traditional medicine to control and reduce the signs and symptoms of heart failure. One study shows small to moderate improvements in life expectancy, physical fitness, anxiety, mood changes, and energy, as well as heart rate variability and left heart ejection fraction percent.^{58,59}

Conclusion

Yogasana has multiple kinds of psychological and physical consequences. However there have been countless different investigations on the effects of pranayama and meditation, and specialists in the field of medical science have only recently begun to take note. In certain cases, the positive effect of asana is acknowledged, and doctors have begun to recommend yoga to patients in addition to medicine. Unfortunately, no appropriate treatments or methods have yet been established in science to neutralize the aggravating components or fundamental cause of stress-induced hypertension. This is a minimally invasive non-drug therapy promoted by doctors for lowering blood pressure.

The distinctions between profitable and unsuccessful therapies imply that effective yoga interventions generally featured yoga postures, breathing exercises, dhyana, and relaxation practices, as well as a balance of these three aspects and continuous practice. They were typically delivered in a hospital or clinic under supervision.

More randomized controlled trials are needed to evaluate the efficacy of yoga on those with a genetic history of high blood pressure, prehypertension, or a hypertension diagnosis.

References

1. WHO W. A global brief on hypertension: silent killer, global public health crisis.

2. Tyagi A, Cohen M. Yoga and hypertension: a systematic review. *Alternative therapies in health and medicine*. 2014;20(2):32-59.
3. Papp ME, Lindfors P, Nygren-Bonnier M, Gullstrand L, Wändell PE. Effects of high-intensity hatha yoga on cardiovascular fitness, adipocytokines, and apolipoproteins in healthy students: a randomized controlled study. *The Journal of Alternative and Complementary Medicine*. 2016 Jan 1;22(1):81-7.
4. Dhungana RR, Khatiwoda SR, Gurung Y, Pedišić Ž, de Courten M. Yoga for hypertensive patients: a study on barriers and facilitators of its implementation in primary care. *Global Health Action*. 2021 Jan 1;14(1):1952753.
5. Wang G, Grosse SD, Schooley MW. Conducting research on the economics of hypertension to improve cardiovascular health. *American journal of preventive medicine*. 2017 Dec 1;53(6):S115-7.
6. Anheyer D, Koch AK, Thoms MS, Dobos G, Cramer H. Yoga in women with abdominal obesity—Do lifestyle factors mediate the effect? Secondary analysis of a RCT. *Complementary Therapies in Medicine*. 2021 Aug 1;60:102741.
7. White DG. Yoga, brief history of an idea. *Yoga in practice*. 2012;5(1):1-23.
8. Wu Y, Johnson BT, Acabchuk RL, Chen S, Lewis HK, Livingston J, Park CL, Pescatello LS. Yoga as antihypertensive lifestyle therapy: a systematic review and meta-analysis. In *Mayo Clinic Proceedings* 2019 Mar 1 (Vol. 94, No. 3, pp. 432-446). Elsevier.
9. Cramer H, Lauche R, Haller H, Steckhan N, Michalsen A, Dobos G. Effects of yoga on cardiovascular disease risk factors: a systematic review and meta-analysis. *International journal of cardiology*. 2014 May 1;173(2):170-83.
10. Nalbant g, lewis s, chattopadhyay k. Content, structure and delivery characteristics of yoga interventions for managing hypertension: a systematic review and meta-analysis of randomised controlled trials. *Journal of hypertension*. 2021 apr 1;39:e399-400.
11. Wang G, Grosse SD, Schooley MW. Conducting research on the economics of hypertension to improve cardiovascular health. *American journal of preventive medicine*. 2017 Dec 1;53(6):S115-7.
12. Anheyer D, Koch AK, Thoms MS, Dobos G, Cramer H. Yoga in women with abdominal obesity—Do lifestyle factors mediate the effect? Secondary analysis of a RCT. *Complementary Therapies in Medicine*. 2021 Aug 1;60:102741.
13. Centers for Disease Control and Prevention (CDC). Vital signs: prevalence, treatment, and control of hypertension--United States, 1999-2002 and 2005-2008. *MMWR. Morbidity and mortality weekly report*. 2011 Feb 4;60(4):103-8.
14. Gascon JJ, Sánchez-Ortuño M, Llor B, Skidmore D, Saturno PJ. Why hypertensive patients do not comply with the treatment: results from a qualitative study. *Family practice*. 2004 Apr 1;21(2):125-30.
15. Unger T, Borghi C, Charchar F, Khan NA, Poulter NR, Prabhakaran D, Ramirez A, Schlaich M, Stergiou GS, Tomaszewski M, Wainford RD. 2020 International Society of Hypertension global hypertension practice guidelines. *Hypertension*. 2020 Jun;75(6):1334-57.
16. WHO W. A global brief on hypertension: silent killer, global public health crisis.
17. Hartley L, Dyakova M, Holmes J, Clarke A, Lee MS, Ernst E, Rees K. Yoga for the primary prevention of cardiovascular disease. *Cochrane Database of Systematic Reviews*. 2014(5).
18. Sherman KJ. Guidelines for developing yoga interventions for randomized trials. *Evidence-Based Complementary and Alternative Medicine*. 2012 Oct 2;2012.
19. Muktibodhananda S. *Hatha Yoga Pradipika*. Munger: Yoga Publications Trust (2013).
20. Singh UP. Psychophysiological effects of yoga for adults with occupational stress: Yoga in the workplace. In *Research-based perspectives on the Psychophysiology of Yoga* 2018 (pp. 359-382). IGI Global.
21. Schmid AA, Sternke EA, Do AN, Conner NS, Starnino VR, Davis LW. The eight limbs of yoga can be maintained in a veteran friendly yoga program. *International Journal of Yoga*. 2021 May;14(2):127.
22. Hagins M, Moore W, Rundle A. Does practicing hatha yoga satisfy recommendations for intensity of physical activity which improves and maintains health and cardiovascular fitness?. *BMC complementary and alternative medicine*. 2007 Dec;7(1):1-9.
23. Larson-Meyer DE. A systematic review of the energy cost and metabolic intensity of yoga. *Medicine and science in sports and exercise*. 2016 Aug 1;48(8):1558-69.
24. Cramer H, Lauche R, Langhorst J, Dobos G. Yoga for depression: A systematic review and meta-analysis. *Depression and anxiety*. 2013 Nov;30(11):1068-83.
25. Büssing A, Michalsen A, Khalsa SB, Telles S, Sherman KJ. Effects of yoga on mental and physical health: a short summary of reviews. *Evidence-based complementary and alternative medicine*. 2012 Oct;2012.
26. Brandani JZ, Mizuno J, Ciolac EG, Monteiro HL. The hypotensive effect of Yoga's breathing exercises: A systematic review. *Complementary therapies in clinical practice*. 2017 Aug 1;28:38-46.
27. Innes KE, Vincent HK. The influence of yoga-based programs on risk profiles in adults with type 2 diabetes mellitus: a systematic review. *Evidence-Based Complementary and Alternative Medicine*. 2007 Dec 1;4:469-86.
28. Riley KE, Park CL. How does yoga reduce stress? A systematic review of mechanisms of change and guide to future inquiry. *Health psychology review*. 2015 Aug 7;9(3):379-96.
29. Pascoe MC, Thompson DR, Ski CF. Yoga, mindfulness-based stress reduction and stress-related physiological measures: A meta-analysis. *Psychoneuroendocrinology*. 2017 Dec 1;86:152-68.
30. Sengupta P. Health impacts of yoga and pranayama: A state-of-the-art review. *International journal of preventive medicine*. 2012 Jul;3(7):444.
31. Manchanda SC, Madan K. Yoga and meditation in cardiovascular disease. *Clinical Research in Cardiology*. 2014 Sep;103:675-80.
32. Gangadurai E, Subramanian G. Role of Augmented Reality and Virtual Reality in Yoga Asana Learning and Practice. *Journal of Embedded Systems and Processing*. 2022 Feb 1;7(1):14-8.
33. Satyanand V, Reddy B, Lilly N, Mahaboobvali S, Mohan D, Salma S. Effect of yoga on hypertension. *Narayana Med J*. 2016;5(1):4-11.
34. Dinesh T, Gaur GS, Sharma VK, Madanmohan T, Kumar KH, Bhavanani AB. Comparative effect of 12 weeks of slow and fast pranayama training on pulmonary function in young, healthy volunteers: A randomized controlled trial. *International journal of yoga*. 2015 Jan;8(1):22.
35. Chandrasekhar M, Ambareesha K, Nikhil C. Effect of pranayama and suryanamaskar on pulmonary functions in medical students. *Journal of clinical and diagnostic research: JCDR*. 2014 Dec;8(12):BC04.
36. Dockery TD. Effectiveness of Ayurvedic Yoga Practices in the Complementary Management of Adult Essential Hypertension.
37. Upadhyay J, Shetty S, Saoji AA, Yadav SS. Effects of Nadishodhana and Bhramari Pranayama on heart rate variability, auditory reaction time, and blood pressure: A randomized clinical trial in hypertensive patients. *Journal of Ayurveda and Integrative Medicine*. 2023 Jul 1;14(4):100774.

38. Tseng AA. Scientific evidence of health benefits by practicing mantra meditation: narrative review. *International Journal of Yoga*. 2022 May;15(2):89.
39. Conversano C, Orru G, Pozza A, Miccoli M, Ciacchini R, Marchi L, Gemignani A. Is mindfulness-based stress reduction effective for people with hypertension? A systematic review and meta-analysis of 30 years of evidence. *International journal of environmental research and public health*. 2021 Mar 11;18(6):2882.
40. Murthy SN, Rao NS, Nandkumar B, Kadam A. Role of naturopathy and yoga treatment in the management of hypertension. *Complementary therapies in clinical practice*. 2011 Feb 1;17(1):9-12.
41. Nejati S, Zahiroddin A, Afrookhteh G, Rahmani S, Hoveida S. Effect of group mindfulness-based stress-reduction program and conscious yoga on lifestyle, coping strategies, and systolic and diastolic blood pressures in patients with hypertension. *The Journal of Tehran University Heart Center*. 2015 Jul 7;10(3):140.
42. Satayanand, V., et al. "Effect of yoga on hypertension." *Narayana Med J* 5.1 (2016): 4-11.
43. Chauhan A, Semwal DK, Mishra SP, Semwal RB. Yoga practice improves the body mass index and blood pressure: A randomized controlled trial. *International journal of yoga*. 2017 May;10(2):103.
44. Devi NV, Sarada N. Effect of yoga on heart rate and blood pressure in mild hypertensive patients (stage I). *Journal of Evolution of Medical and Dental Sciences*. 2017 Mar 16;6(22):1754-8.
45. Hewett ZL, Pampa KL, Smith CA, Fahey PP, Cheema BS. Effect of a 16-week Bikram yoga program on heart rate variability and associated cardiovascular disease risk factors in stressed and sedentary adults: A randomized controlled trial. *BMC complementary and alternative medicine*. 2017 Dec;17(1):1-1.
46. Dhungana RR, Pedisic Z, Joshi S, Khanal MK, Kalauni OP, Shakya A, Bhurtel V, Panthi S, Ramesh Kumar KC, Ghimire B, Pandey AR. Effects of a health worker-led 3-month yoga intervention on blood pressure of hypertensive patients: a randomised controlled multicentre trial in the primary care setting. *BMC Public Health*. 2021 Dec;21(1):1-1.
47. Penrod NM, Moore JH. Antihypertensive effects of yoga in a general patient population: real-world evidence from electronic health records, a retrospective case-control study. *BMC Public Health*. 2022 Dec;22(1):1-9.
48. Pandey A, Pandey A, Pandey AS, Bonsignore A, Auclair A, Poirier P. Impact of Yoga on Global Cardiovascular Risk as an Add-On to a Regular Exercise Regimen in Patients With Hypertension. *Canadian Journal of Cardiology*. 2023 Jan 1;39(1):57-62.
49. Upadhyay J, Shetty S, Saoji AA, Yadav SS. Effects of Nadishodhana and Bhramari Pranayama on heart rate variability, auditory reaction time, and blood pressure: A randomized clinical trial in hypertensive patients. *Journal of Ayurveda and Integrative Medicine*. 2023 Jul 1;14(4):100774.
50. Elliott WJ, Izzo Jr JL. Device-guided breathing to lower blood pressure: case report and clinical overview. *Medscape General Medicine*. 2006;8(3):23.
51. Rutledge T, Hogan BE. A quantitative review of prospective evidence linking psychological factors with hypertension development. *Psychosomatic medicine*. 2002 Sep 1;64(5):758-66.
52. Sparrenberger F, Cicheler FT, Ascoli AM, Fonseca FP, Weiss G, Berwanger O, Fuchs SC, Moreira LB, Fuchs FD. Does psychosocial stress cause hypertension? A systematic review of observational studies. *Journal of human hypertension*. 2009 Jan;23(1):12-9.
53. Walton KG, Pugh ND, Gelderloos P, Macrae P. Stress reduction and preventing hypertension: preliminary support for a psychoneuroendocrine mechanism. *The journal of alternative and complementary medicine*. 1995 Jun 1;1(3):263-83.
54. Julius S, Nesbitt S. Sympathetic overactivity in hypertension: a moving target. *American journal of hypertension*. 1996 Nov 1;9(S4):113S-20S.
55. Imumorin IG, Dong Y, Zhu H, Poole JC, Harshfield GA, Treiber FA, Snieder H. A gene-environment interaction model of stress-induced hypertension. *Cardiovascular Toxicology*. 2005 Jun;5:109-32.
56. Strahler J, Kirschbaum C, Rohleder N. Association of blood pressure and antihypertensive drugs with diurnal alpha-amylase activity. *International journal of psychophysiology*. 2011 Jul 1;81(1):31-7.
57. Sieverdes JC, Mueller M, Gregoski MJ, Brunner-Jackson B, McQuade L, Matthews C, Treiber FA. Effects of Hatha yoga on blood pressure, salivary α -amylase, and cortisol function among normotensive and prehypertensive youth. *The Journal of Alternative and Complementary Medicine*. 2014 Apr 1;20(4):241-50.
58. Ankolekar VH, Reddy GG, Sanju CS, Mamatha H. Role of yoga intervention on quality of life and prehypertension.
59. Cohen DL, Bloedon LT, Rothman RL, Farrar JT, Galantino ML, Volger S, Mayor C, Szapary PO, Townsend RR. Iyengar yoga versus enhanced usual care on blood pressure in patients with prehypertension to stage I hypertension: a randomized controlled trial. *Evidence-Based Complementary and Alternative Medicine*. 2011 Jan 1;2011.

How to cite this article: Devi D, Bhattacharya S. Role of Asana, Pranayama, and Meditation as an Add-on Therapy in Regulation of Hypertension. *Hypertens J*. 2023;9(4):7-11

Source of support: Nil, **Conflicts of interest:** None

This work is licensed under a Creative Commons Attribution 4.0 International License. The images or other third party material in this article are included in the article's Creative Commons license, unless indicated otherwise in the credit line; if the material is not included under the Creative Commons license, users will need to obtain permission from the license holder to reproduce the material. To view a copy of this license, visit <http://creativecommons.org/licenses/by/4.0/>