International Journal of Applied Research 2025; 11(1): 188-194

ISSN Print: 2394-7500
ISSN Online: 2394-5869
Impact Factor (RJIF): 8.4
IJAR 2025; 11(1): 188-194
www.allresearchjournal.com
Received: 24-10-2024
Accepted: 25-11-2024

Rajeevan PV
Research Scholar, Department of Yoga, School of Ancient Indian Studies, VELS Institute of Science, Technology & Advanced Studies, Chennai, Tamil Nadu, India

Dr. S Natarajan
Associate Professor, Department of Yoga, School of Ancient Indian Studies, VELS Institute of Science, Technology & Advanced Studies, Chennai, Tamil Nadu, India

Dr. CV Jayanthi
Assistant Professor, Department of Yoga, School of Ancient Indian Studies, VELS Institute of Science, Technology & Advanced Studies, Chennai, Tamil Nadu, India

Corresponding Author:
Rajeevan PV
Research Scholar, Department of Yoga, School of Ancient Indian Studies, VELS Institute of Science, Technology & Advanced Studies, Chennai, Tamil Nadu, India

Impact of Chandra Bedha pranayama on pulse rate and the blood pressure level of persons with hypertension

Rajeevan PV, S Natarajan and CV Jayanthi

Abstract
High blood pressure is a major risk factor for coronary heart disease, and the pressure levels have been shown to be positively and progressively related to the risk for stroke and coronary heart disease. Blood pressure can be regularised with YOGIC management, which includes asana, pranayama, and meditation. The associated symptoms like stress, depression, anxiety, etc can also be treated along with hypertension. The present study was done to assess the efficacy of selected yoga practices for reducing high blood pressure. The parasympathetic nervous system (PNS), part of the autonomic nervous system, plays a critical role in maintaining cardiovascular homeostasis and counteracting the effects of hypertension. Its activation promotes relaxation, lowers heart rate, and reduces blood pressure by balancing the hyperactivity of the sympathetic nervous system (SNS), often a hallmark of hypertension. By restoring autonomic balance and counteracting the effects of sympathetic hyper activation, the parasympathetic nervous system plays a vital role in the prevention and management of hypertension.
Yoga therapy is the expert use of yoga's tenets and practices to enhance health and wellbeing in a therapeutic setting. It involves goal-setting, customized evaluation, and lifestyle management. The adoption of Various Sukshma Vyayams for the loosening up of muscles, joints synchronised with inhalation and exhalation, Chandra bedha pranayama, and Savasana are included in the training program for the hypertensive volunteers. The participants are monitored with the guidance of Doctors and staff at the venue. The goal of the current study was to determine whether these sookshma vyayams and Chandrabedha pranayama may effectively lower high blood pressure among the middle-aged men who had irregular blood pressure variations.
Aim & Objectives: The present study set out to investigate the potential efficaciousness of specific yoga poses in reducing hypertension in middle-aged males. The aim of the study was to determine how patients with hypertension responded to yoga therapy.
Materials and methods: 40 patients with pre- hypertension between the ages of 35-50 years were selected. After a rest of 15-20 minutes in a comfortable posture their baseline physiological parameters such as pulse rate. Systolic blood pressure (SBP) and diastolic blood pressure (DBP) were recorded by an automated digital Sphygmomanometer. The controlled group and the experimental group were volunteer to participate and the experimental were given a proper training program.
Results: A significant result was achieved during the research. The systolic and the Diastolic blood pressure were noticed at a healthy measure.
Conclusion: It is evident from the results that yoga plays an important role in the lifestyle diseases, especially for the hypertensive men so as to prevent the later stage of hypertension. Yoga therapy offers a holistic and effective approach to managing hypertension by addressing both physiological and psychological factors. Through practices such as basic asanas, chandrabedha pranayama, meditation, and relaxation techniques, yoga helps regulate blood pressure by enhancing parasympathetic activity, reducing stress, improving vascular health, and promoting overall well-being. Its ability to decrease sympathetic hyperactivity and support cardiovascular function makes it a valuable adjunct to conventional treatments. By incorporating yoga therapy into daily life, individuals with hypertension can experience improved blood pressure control, reduced reliance on medications, and enhanced quality of life. Future research should continue to explore the long-term benefits and mechanisms of yoga in diverse populations to solidify its role in hypertension management.

Keywords: Yoga, blood pressure, sympathetic, hypertension

Introduction
Blood pressure is a fundamental indicator of cardiovascular function that reflects the force of blood flow against the inner walls of blood vessels.

This force is determined by several factors, including vascular resistance and cardiac workload. Knowledge of blood pressure is crucial for maintaining optimal health and preventing a range of conditions, including but not limited to heart disease, stroke, and kidney failure. The diastolic and systolic pressures together make up blood pressure. Systolic pressure, which is the higher pressure and the first value recorded, is the force that blood applies to the arterial walls as the heart beats to pump blood to the tissues and peripheral organs. The second measurement, the diastolic pressure, represents the lower pressure and the amount of residual pressure that the heart applies to the arteries when it relaxes in between beats.

Hypertension, is a significant risk factor for cardiovascular disease, is often evaluated in clinical settings using reference ranges for various haematological and immunological parameters. Specific haematological parameters, such as red blood cells, red cell distribution width, mean cellular/corpuscular haemoglobin, mean cellular/corpuscular haemoglobin concentration, haemoglobin, haematocrit, mean cellular/corpuscular volume, platelet count, white blood cells, basophils, lymphocytes, neutrophils, monocytes, eosinophils, neutrophil-to-lymphocyte ratio, monocyte-to-lymphocyte ratio, platelet-to-lymphocyte ratio, have a role to play in the development of hypertension.

There can be several causes of prehypertension, including genetics, age, lack of physical activity, unhealthy diet, stress, smoking, alcohol consumption, and certain underlying medical conditions such as kidney disease, diabetes, and sleep apnea. It is important to identify the underlying cause of prehypertension and take appropriate measures to manage it in order to prevent it from progressing to hypertension.

The range between normal and high blood pressure is known as prehypertension. It becomes hypertension, or high blood pressure, if it goes above this range. It is important to treat prehypertension carefully. It means you are headed toward high blood pressure, which can cause a number of other health issues. However, that does not preclude its reversibility. You can prevent damage to your arteries and lower your blood pressure to healthy levels by implementing important lifestyle modifications. Prehypertension may arise due to many factors. This comprises: -

- **Insufficient physical activity:** Living a sedentary lifestyle can make your arteries pump blood more forcefully. This is due to the fact that exercise fortifies the heart, facilitating more effective blood pumping. - Specific Posture / asanas.
- **A greater consumption of salt:** Your arteries' blood pressure rises when you consume sodium. Packaged meals, store-bought soups and sauces, and processed meats are a few examples of foods high in sodium. The Satvik diet.
- **Vaping and smoking:** Nicotine's compounds have the ability to narrow blood vessels, raising blood pressure. – Paranayama.
- **Consumption of alcohol:** By restricting your blood vessels, drinking too much alcohol can also cause your blood pressure to rise. - Pranayama and meditation.
- **Insufficient sleep:** When you sleep, your blood pressure normally drops. However, a lack of sleep might cause your blood pressure to remain elevated for an extended period of time. – Savasana.

Hypertension, or high blood pressure, is when your blood travels through blood vessels with more force than is considered healthy. When blood pressure is high, it can damage artery and blood vessel walls over time. This leads to dangerous complications and even death if left untreated. Blood pressure is measured by systolic over diastolic pressure. Systolic refers to the pressure when the heart is beating, and diastolic refers to the pressure when the heart rests between beats. For an average adult, a blood pressure reading is considered normal if it's below 120/80 mmHg.

Role of the Parasympathetic Nervous System (PNS)

Here the most significant mechanism for the present study is the operative principle of the Parasympathetic Nervous System, which has a great role in regularising the blood pressure. The study of brain waves theory is also included for the strengthening of effective yoga therapy addressing an important root cause of hypertension.

The Parasympathetic Nervous System (PNS) is a division of the autonomic nervous system responsible for the "rest and digest" functions of the body. It plays a critical role in regulating heart function, helping maintain homeostasis and counterbalance the effects of the sympathetic nervous system, which triggers the "fight or flight" response. The Parasympathetic Nervous System reduces heart rate by releasing acetylcholine through the vagus nerve, which acts on the sinoatrial (SA) node, the heart's natural pacemaker. This action decreases the frequency of electrical impulses, leading to a slower heart rate (bradycardia). Parasympathetic stimulation reduces the contractility of the heart's atria, though it has minimal effect on the ventricles compared to the sympathetic system. This leads to a decrease in cardiac output when the body is at rest.

The PNS increases heart rate variability, which is the variation in the time interval between consecutive heartbeats. Higher HRV is a sign of a healthy and adaptable cardiovascular system. By slowing the heart rate and decreasing cardiac workload, the PNS lowers the heart's oxygen requirements, improving efficiency. The PNS helps regulate blood pressure by reducing the heart rate and relaxing blood vessels, decreasing vascular resistance.

Vagus Nerve

The vagus nerve is the primary conductor for the parasympathetic signals to the heart. It releases acetylcholine at the SA and atrioventricular (AV) nodes, slowing the rate at which these nodes generate electrical impulses. The PNS counteracts the effects of the sympathetic nervous system by inhibiting the release of norepinephrine and epinephrine, which accelerate heart rate and increase contractility.

The PNS and Heart rate

After exercise or stress, the parasympathetic system facilitates heart rate recovery, a measure of cardiovascular fitness. Slow heart rate recovery can indicate poor parasympathetic function and is associated with increased cardiovascular risk. An imbalance favoring sympathetic dominance over parasympathetic activity can lead to hypertension. Restoring PNS activity can help lower blood pressure. Enhanced parasympathetic activity can sometimes trigger bradyarrhythmias (abnormally slow heart rhythms) but typically prevents tachyarrhythmias (abnormally fast heart rhythms). Parasympathetic dysfunction is often

observed in heart failure, contributing to disease progression. Enhancing PNS activity is a potential therapeutic approach.

Yoga at its application mode

The ancient medical treatment method, YOGA proved its efficacy to prevent and cure many lifestyle diseases. Hypertension is one of the main causes of cardiovascular disorders at the beginning and ends up in disaster after becoming a serious victim of high blood pressure. Yoga is a means of balancing and harmonizing the body, mind, and emotions through the practices of asana, pranayama, mudra, bandha, shatkarma, and meditation and must be achieved before union can take place with the higher reality. When we look around, it is evident from the recent cardiac arrests, and heart attacks leading to a great loss of dependents even after medication. Yoga can do much more than medicine can reach. The union of mind and the body is the aspect that plays a vital role in curing any disease.

Our sympathetic nervous system triggers the fight-or-flight reaction when we are under stress, acting as though we are in danger. While not all stress is harmful, prolonged stress can cause a wide range of conditions, including heart disease, depression, anxiety, and lowered immunity. Yoga has been shown to be a particularly useful method for stress relief. It has gained enormous popularity because of its physical advantages, which include toned muscles and enhanced flexibility. However, what really gives it such potency are the internal effects. Research cited in a reliable source have connected yoga to decreased levels of the stress hormone cortisol, enhanced pain tolerance and resilience, elevated mood, and decreased anxiety. It's even thought that some yoga positions and extended hold times stimulate the parasympathetic nerve system, which is our body's rest and digest response.

Chandrabhedana Pranayama also known as left-nostril breathing, is a yogic practice that emphasizes inhalation through the left nostril (associated with the moon or "Chandra" channel) and exhalation through the right nostril. This practice is believed to activate the parasympathetic nervous system and induce a calming effect on the body, making it particularly beneficial for managing blood pressure. The following are the findings how the said pranayama affected the blood pressure.

- The activation of Parasympathetic Nervous System. Inhaling through the left nostril stimulates the Ida Nadi, which is linked to the parasympathetic nervous system (rest-and-digest mode).
- This reduces the activity of the sympathetic nervous system, responsible for the fight-or-flight response, leading to a decrease in blood pressure. Slow, deep breathing techniques, such as pranayama or diaphragmatic breathing, stimulate the vagus nerve and enhance parasympathetic tone.
- The calming effect of this pranayama slows the heart rate, reducing the workload on the heart and promoting better cardiovascular efficiency.
- Lower heart rates are directly associated with reduced systolic and diastolic blood pressure.
- Chandrabhedana Pranayama restores equilibrium between the sympathetic and parasympathetic systems, reducing the stress-induced surges in blood pressure.
- Controlled breathing ensures better oxygen exchange, which relaxes blood vessels and improves blood flow. Practices like mindfulness meditation and yoga reduce SNS dominance and promote PNS activity, leading to lower blood pressure.
- Enhanced oxygenation contributes to the regulation of blood pressure.
- Stress and anxiety are significant contributors to hypertension. Chandrabhedana helps by calming the mind, reducing cortisol (stress hormone) levels, and inducing a state of relaxation.
- Activating the vagus nerve through left-nostril breathing enhances vagal tone, which is associated with lower blood pressure and improved cardiovascular health. Slow, diaphragmatic breathing stimulates the vagus nerve, enhancing PNS activity and shifting brainwave activity toward relaxation.
- Chandrabhedana reduces the production of adrenaline and cortisol, which are stress-induced hormones that elevate blood pressure. PNS activation suppresses cortisol and adrenaline production, reducing the impact of stress on blood pressure.
- Relaxation of smooth muscles in blood vessels improves vasodilation, lowering peripheral resistance and thus reducing blood pressure. Parasympathetic activation promotes the release of nitric oxide, a vasodilator, which relaxes blood vessels and decreases blood pressure.
- Controlled breathing enhances the sensitivity of baroreceptors, which regulate blood pressure by detecting changes in blood vessel stretch.
- The calming effects of left-nostril breathing have been linked to improved cardiovascular parameters in individuals with hypertension. Increased parasympathetic tone reduces inflammation by modulating the release of pro-inflammatory cytokines, which can contribute to vascular stiffness and hypertension.
- The PNS reduces the resting heart rate and heart rate variability, improving cardiovascular efficiency and reducing strain on the heart. The PNS enhances baroreflex function, a key mechanism that stabilizes blood pressure by detecting changes in arterial pressure and initiating compensatory responses.
- A proper training schedule to increase heart rate variability can enhance parasympathetic activity and autonomic balance. Regular sookshma vyayams and preliminary asanas in connection with the Chandrabedha pranayama improves heart rate variability and parasympathetic function, while reducing sympathetic hyperactivity.
- Quality sleep, and Savasana techniques enhances parasympathetic function and reduces cortisol levels, helping regulate blood pressure. Good sleep hygiene supports delta wave activity and allows the PNS to maintain its restorative functions.
- Yoga practices that incorporate slow movements and controlled breathing enhance PNS activity, promoting alpha and theta waves. These tools help individuals consciously shift brainwave patterns and increase parasympathetic dominance.

By promoting relaxation, reducing stress, and improving cardiovascular function, Chandrabhedana Pranayama serves as an effective non-pharmacological tool for managing blood pressure, especially when practiced regularly and in

conjunction with a healthy lifestyle. By modulating heart rate, promoting relaxation, and supporting overall cardiovascular health, the parasympathetic nervous system plays a crucial role in heart function and long-term health.

Methodology

Sample size: 38 Pre-hypertensive middle-aged Men volunteers aged between 35 -50 yrs. They are divided into two groups Experimental groups (15) and Controlled group (15). Experimental group practises Yoga while the Controlled group did not do any yoga practice, and the study structures are as follows: -.

- Study Design: Simple Random Group Design
- Study Duration: 5 days in a week for 8 weeks.
- Variables: Systolic, diastolic blood pressure and Resting Pulse Rate.
- Study Instrument – Sphygmomanometer.

Interventional Modules

According to the traditional hatha yoga text, selective Sookshma vyayams from the Pawanamuktasana series were incorporated prior to the pranayama. Each and every movement are to be synchronised with proper inhalation and exhalation process to enrich the path with spontaneous flow of parana / vital energy creating an easy access for the Chandra Bedha pranayama. The training commenced for eight weeks. Followed by Meditation and Savasana. Savasana regularizes the resting pulse rate and improves abdominal and crevicular, adham pranayama breathing patterns in addition to complete relaxation at a very conscious state. (references are Asana-Pranayama-Mudra-and-Bandhas-Bihar-School, Gheraṇḍa saṃhita)

Inclusion Criteria

- Male Volunteers with Hypertension
- Subject aged between 35 to 50 years
- Subjects willing to participate in the study regularly.

Exclusion criteria

- Subjects already practice yoga
- Subjects who has undergone surgery
- Pacemaker and high-risk personnel

Statistical Technique: Analysis of Variance

Increased parasympathetic tone and the ensuing reduction in blood pressure may relax arterial baroreceptors, resulting in a reduction in the inhibition of the supraoptic nucleus of the hypothalamus by γ-aminobutyric acid. This, in turn, may trigger the release of arginine vasopressin (AVP). Positive effects are known to be caused by AVP. Lastly, yoga may increase glutamate transmission in the arcuate nucleus of the medial hypothalamus and activate the prefrontal cortex. This will release beta-endorphin, which in turn produces anxiolytics, which may lower cortisol.

Level of Significance

The probability level below which we rejected the hypothesis is termed as the level of significance. The F-ratio that obtained from the analysis of value (DF=1, 38) for significant at 0.05 level.

Descriptive analysis

Descriptive analysis involves calculation of the measure of central tendencies and the measures of variability. The computed values of the mean and the standard deviation are used to describe the properties of the particular sample. Descriptive statistics is used to reduce the bulk of data into manageable size. The mean and standard deviation values of Pre-test and Post test score of experimental group and control group were calculated and are given in Table 1

Table 1: Analysis of co-variance of the pre test and post test means of the experimental group and control group in systolic blood pressure

Group	Experimental	Control	Source of variance	Sum of squares	df	Mean square	'F' Ratio
Pre Test Mean	161.90	162.65	Between	5.625	1	5.625	0.141 NS
SD	6.18	6.45	Within	1518.350	38	39.957	
Post test Mean	126.85	166.75	Between	15920.100	1	15920.100	23.09* S
SD	5.46	10.3	Within	2584.300	38	68.008	
Adjusted Post test mean	162.27	146.80	Between	14085.63	1	14085.63	18.56* S
			Within	2391.63	38	57.016	

S - Significant
NS – Not Significant

From the table 4.1 results proved that the pre test mean score on experimental group is 161.90 and control group is 162.65. Therefore, it is inferred that the obtained calculated 'F' value is 0.141 for Pre-Test mean score. Therefore the framed research hypothesis is rejected. It is inferred that there is no significant difference between the pre-test means of the systolic blood pressure. Wherever, the Post test mean score on experimental group is 126.85 and control group is 166.75. Therefore, it is evident that the obtained 'F' value 23.09 for Post-Test mean score. Therefore the framed research hypothesis is accepted. Further, the above table taking into consideration of the adjusted post test mean score on experimental group is 162.27, control group is 146.80. Therefore, it is evident that the calculated 'F' value is 18.56. Therefore the framed research hypothesis is accepted. It is inferred that there is a significant difference between the adjusted post-test means of the systolic blood pressure.

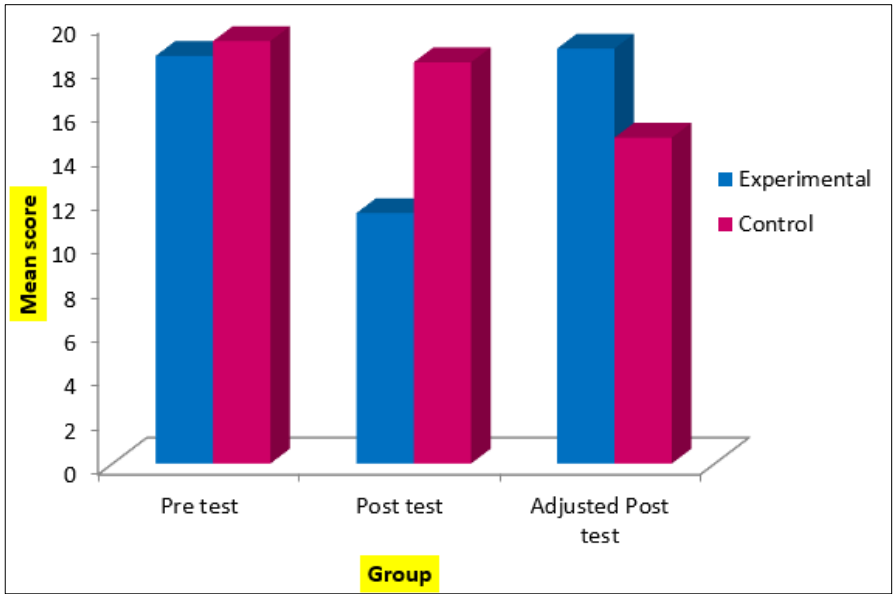

Fig 1: Analysis of co-variance of the pre test and post test means of the experimental group and control group in systolic blood pressure

Table 2: Analysis of co-variance of the pre test and post test means of the experimental group and control group in diastolic blood pressure

Group	Experimental	Control	Source of variance	Sum of squares	df	Mean square	'F' Ratio
Pre Test Mean	89.10	88.60	Between	2.500	1	2.500	0.112 NS
SD	3.53	5.66	Within	848.600	38	22.332	
Post test Mean	81.65	90.85	Between	846.400	1	846.400	79.06* S
SD	1.08	4.49	Within	407.100	38	10.713	
Adjusted Post test mean	88.85	86.25	Between	750.639	1	750.639	46.03* S
			Within	386.063	38	8.593	

S - Significant
NS – Not Significant

It is inferred from the above table results shows that the pre test mean score on experimental group is 89.10 and control group is 88.60. Therefore, it is inferred that the obtained calculated 'F' value is 0.112 for Pre-Test mean score. Therefore the framed research hypothesis is rejected. It is inferred that there is no significant difference between the pre-test means of the diastolic blood pressure. Wherever, the Post test mean score on experimental group is 81.65 and control group is 90.85. Therefore, it is evident that the obtained 'F' value 79.06 for Post-Test mean score. Therefore the framed research hypothesis is accepted. Further, the above table taking into consideration of the adjusted post test mean score on experimental group is 88.85, control group is 86.25. Therefore, it is evident that the calculated 'F' value is 46.03. Therefore the framed research hypothesis is accepted. It is inferred that there is a significant difference between the adjusted post-test means of the diastolic blood pressure.

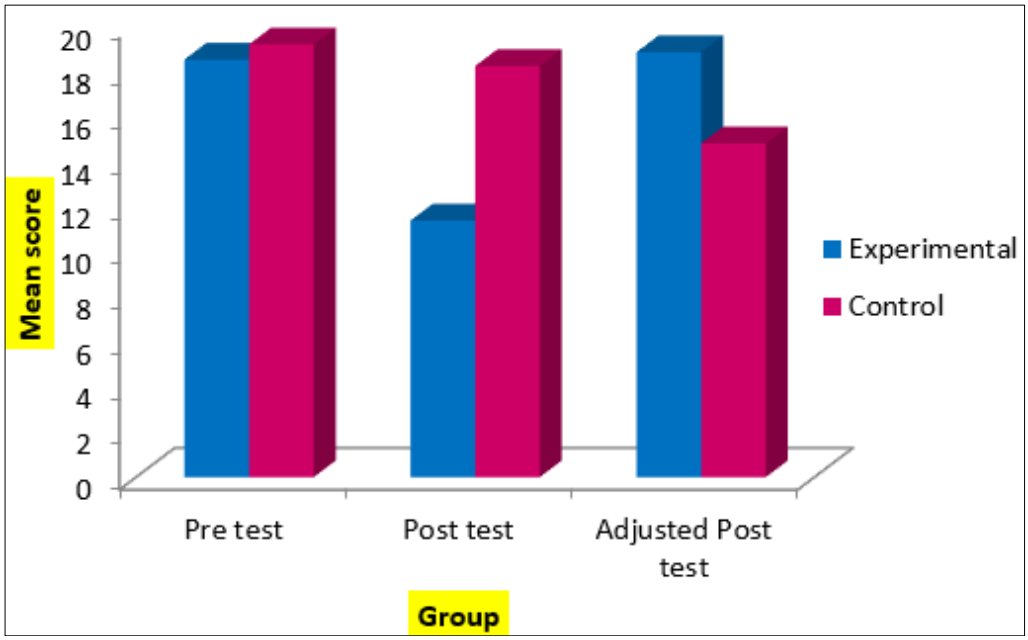

Fig 2: Analysis of co-variance of the pre test and post test means of the experimental group and control group in diastolic blood pressure

Table 3: Analysis of co-variance of the pre test and post test means of the experimental group and control group in pulse rate

Group	Experimental	Control	Source of variance	Sum of squares	df	Mean square	'F' Ratio
Pre Test Mean	90.75	90.40	Between	1.225	1	1.225	0.070 NS
SD	3.71	4.62	Within	668.550	38	17.593	
Post test Mean	75.65	89.95	Between	2044.900	1	2044.900	146.7* S
SD	2.25	4.77	Within	529.500	38	13.934	
Adjusted Post test mean	90.57	82.80	Between	1950.361	1	1950.361	38.74* S
			Within	466.087	38	10.480	

S – Significant
NS – Not Significant

From the table 4.3 results proved that the pre test mean score on experimental group is 90.75 and control group is 90.40. Therefore, it is inferred that the obtained calculated 'F' value is 0.070 for Pre-Test mean score. Therefore the framed research hypothesis is rejected. It is inferred that there is no significant difference between the pre-test means of the pulse rate. Wherever, the Post test mean score on experimental group is 75.65 and control group is 89.95. Therefore, it is evident that the obtained 'F' value 146.7 for Post-Test mean score. Therefore the framed research hypothesis is accepted. Further, the above table taking into consideration of the adjusted post test mean score on experimental group is 90.57, control group is 82.80. Therefore, it is evident that the calculated 'F' value is 38.74. Therefore the framed research hypothesis is accepted. It is inferred that there is a significant difference between the adjusted post-test means of the pulse rate.

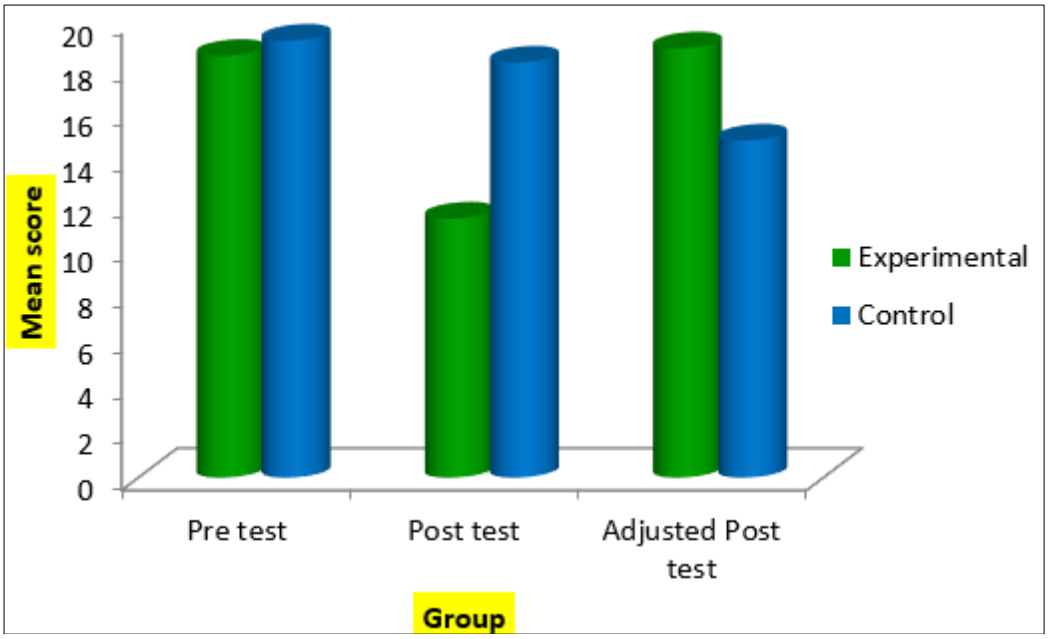

Fig 3: Analysis of co-variance of the pre test and post test means of the experimental group and control group in pulse rate

Conclusion

The present study has shown an efficacy of selective yogic practices on resting pulse rate and blood pressure among hypertensive middle aged men. Yoga, being a lifestyle incorporating Ashtanga yoga, managing stress and thereby creating positive attitude towards life. Hypertension is a common cause for cardiac disorders and by adapting yogic measures, we can easily control our heart rate and can increase our life span.

Strength of study

The yoga training program was created by yoga professionals and guides following a thorough assessment of the literature. It was the ideal blend of asana and pranayama, specifically tailored to the ailment being studied. The study sample exhibited excellent compliance, with no dropouts. Patients in the experimental group were self-motivated to practice yoga and voluntarily reported to the department of holistic medicine. Additionally, the control group was constantly watched.

Limitations of the study

Direct supervision of the patients was not possible for the entire period of the study. Dietary data were not recorded. Long-term study was not possible due to threat of noncompliance of the patients.

Conflicts of interest

All authors have none to declare.

References

1. Gillespie CF, Nemeroff CB. Hypercortisolemia and depression. Psychosom Med. 2005;67(Suppl 1):S26–8.
2. Christensen MV, Kessing LV. The hypothalamo-pituitary-adrenal axis in major affective disorder: A review. Nord J Psychiatry. 2001;55:359–63.
3. Miller GE, Rohleder N, Stetler C, Kirschbaum C. Clinical depression and regulation of the inflammatory response during acute stress. Psychosom Med. 2005;67:679–87.
4. Raison CL, Miller AH. When not enough is too much: The role of insufficient glucocorticoid signaling in the

pathophysiology of stress-related disorders. Am J Psychiatry. 2003;160:1554–65.
5. Janakiramaiah N, Gangadhar BN, Naga Venkatesha Murthy PJ, Harish MG, Subbakrishna DK, Vedamurthachar A. Antidepressant efficacy of Sudarshan Kriya Yoga (SKY) in melancholia: A randomized comparison with electroconvulsive therapy (ECT) and imipramine. J Affect Disord. 2000;57:255–9.
6. Vedamurthachar A, Janakiramaiah N, Hegde JM, Shetty TK, Subbakrishna DK, Sureshbabu SV, *et al*. Antidepressant efficacy and hormonal effects of Sudarshana Kriya Yoga (SKY) in alcohol dependent individuals. J Affect Disord. 2006;94:249–53.
7. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders. Text Revision. 4th ed. Washington, DC: American Psychiatric Association; 2000.
8. Sheehan DV, Lecrubier Y, Sheehan KH, Amorim P, Janavs J, Weiller E, *et al*. The Mini-International Neuropsychiatric Interview (M.I.N.I.): The development and validation of a structured diagnostic psychiatric interview for DSM-IV and ICD-10. J Clin Psychiatry. 1998;59(Suppl 20):22–33.
9. Hamilton M. A rating scale for depression. J Neurol Neurosurg Psychiatry. 1960;23:56–62.
10. Schüle C, Baghai TC, Eser D, Zwanzger P, Jordan M, Buechs R, *et al*. Time course of hypothalamic-pituitary-adrenocortical axis activity during treatment with reboxetine and mirtazapine in depressed patients. Psychopharmacology (Berl). 2006;186:601–11.
11. Hinkelmann K, Moritz S, Botzenhardt J, Muhtz C, Wiedemann K, Kellner M, *et al*. Changes in cortisol secretion during antidepressive treatment and cognitive improvement in patients with major depression: A longitudinal study. Psychoneuroendocrinology. 2012;37:685–92.
12. Schüle C, Baghai T, Schmidbauer S, Bidlingmaier M, Strasburger CJ, Laakmann G. Reboxetine acutely stimulates cortisol, ACTH, growth hormone and prolactin secretion in healthy male subjects. Psychoneuroendocrinology. 2004;29:185–200.
13. Smith MA, Makino S, Kvetnansky R, Post RM. Stress and glucocorticoids affect the expression of brain-derived neurotrophic factor and neurotrophin-3 mRNAs in the hippocampus. J Neurosci. 1995;15:1768–77.
14. Schaaf MJ, de Jong J, de Kloet ER, Vreugdenhil E. Downregulation of BDNF mRNA and protein in the rat hippocampus by corticosterone. Brain Res. 1998;813:112–20.
15. Bravo JA, Díaz-Veliz G, Mora S, Ulloa JL, Berthoud VM, Morales P, *et al*. Desipramine prevents stress-induced changes in depressive-like behavior and hippocampal markers of neuroprotection. Behav Pharmacol. 2009;20:273–85.
16. Lupien SJ, de Leon M, de Santi S, Convit A, Tarshish C, Nair NP, *et al*. Cortisol levels during human aging predict hippocampal atrophy and memory deficits. Nat Neurosci. 1998;1:69–73.
17. Knoops AJ, Gerritsen L, van der Graaf Y, Mali WP, Geerlings MI. Basal hypothalamic pituitary adrenal axis activity and hippocampal volumes: The SMART-Medea study. Biol Psychiatry. 2010;67:1191–8.
18. Gold SM, Kern KC, O'Connor MF, Montag MJ, Kim A, Yoo YS, *et al*. Smaller cornu ammonis 2-3/dentate gyrus volumes and elevated cortisol in multiple sclerosis patients with depressive symptoms. Biol Psychiatry. 2010;68:553–9.
19. Mohandas E. Neurobiology of spirituality. Mens Sana Monogr. 2008;6:63–80.
20. Renaud LP. CNS pathways mediating cardiovascular regulation of vasopressin. Clin Exp Pharmacol Physiol. 1996;23:157–60.
21. Pietrowsky R, Braun D, Fehm HL, Pauschinger P, Born J. Vasopressin and oxytocin do not influence early sensory processing but affect mood and activation in man. Peptides. 1991;12:1385–91.
22. Yadid G, Zangen A, Herzberg U, Nakash R, Sagen J. Alterations in endogenous brain beta-endorphin release by adrenal medullary transplants in the spinal cord. Neuropsychopharmacology. 2000;23:709–16.
23. Janal MN, Colt EW, Clark WC, Glusman M. Pain sensitivity, mood and plasma endocrine levels in man following long-distance running: Effects of naloxone. Pain. 1984;19:13–25.