Research

Immediate Effect of Sukha Pranayama on Cardiovascular Variables in Patients of Hypertension

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Abstract: Hypertension is one of the most common health disorders, and yoga has been shown to be an effective adjunct therapy in its management. Earlier studies have reported blood pressure (BP)-lowering effects of slow, deep breathing after 3 weeks and 3 months of training and beneficial immediate effects of slow, deep breathing in reducing premature ventricular complexes and lowering blood pressure. None of these immediate studies used the concept of pranayama, involving conscious internal awareness of the whole breathing process. This study was undertaken to determine the immediate cardiovascular effects of sukha pranayama in hypertensive patients.

Methods: Twenty-three hypertensive patients attending the Yoga OPD at JIPMER were recruited for the study and instructed to perform sukha pranayama for 5 minutes at the rate of 6 breaths/min. This pranayama involves conscious, slow and deep breathing with equal duration for inhalation and exhalation. Heart rate (HR) and BP were recorded before and immediately after the intervention. Results: Post-intervention statistical analysis revealed a significant ($p < .05$) reduction in HR and a highly significant ($p < .001$) reduction in systolic pressure, pulse pressure, mean arterial pressure, rate-pressure product, and double product with an insignificant fall in diastolic pressure.

Discussion: It is concluded that sukha pranayama at the rate of 6 breaths/minute can reduce HR and BP in hypertensive patients within 5 minutes of practice. This may be due to a normalization of autonomic cardiovascular rhythms as a result of increased vagal modulation and/or decreased sympathetic activity and improved baroreflex sensitivity. Further studies are required to understand possible mechanisms underlying this beneficial immediate effect and to determine how long such a beneficial effect persists.

Key words: hypertension, pranayama, yoga, breathing, blood pressure, cardiovascular disease, vagal tone

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Background

One of the most common health disorders today is hypertension, or high blood pressure (BP). This health challenge affects millions of people all over the world and is a major risk factor for stroke, coronary artery disease, and organ failure. Lifestyle modifications are universally accepted not only as the first step in the management of hypertension but also as a way to prevent hypertension. Lifestyle modifications may eliminate the need for drug therapy in borderline hypertension and decrease the dosage and/or reduce the number of drugs need in established hypertension. It may also decrease the risk of cardiovascular diseases directly and indirectly.

Yoga has been found to be an effective adjunct therapy for hypertension. Yoga is a true lifestyle intervention that may include practices such as asana (postures), pranayama (breathing), meditation, relaxation, dietary changes, and other techniques that have been shown to aid in reducing cardiovascular risk and high blood pressure. Breathing techniques are increasingly being used for therapeutic purposes, and research suggests that pranayama may be especially helpful in managing hypertension.

For example, a recent study by Pramanik and colleagues has reported reduction in heart rate and blood pressure following 5 minutes of slow-paced bhastrika pranayama. Earlier studies from our laboratory have shown the heart rate- and blood pressure-lowering effects of practicing slow, deep breathing on a regular basis for 3 weeks and 3 months. Deep breathing has also been reported to reduce premature ventricular complexes. Joseph and colleagues demonstrated a decrease in blood pressure after 3 minutes of slow breathing at the rate of 6 breaths/min, while Kaushika and colleagues demonstrated that even a single 10-minute session of slow breathing could produce a temporary fall in blood pressure. Grossman and colleagues reported a clinically significant reduction in blood pressure after 8 weeks of slow deep breathing for 10 minutes a day using a Breathe with Interactive Music (BIM) apparatus.

However, none of these studies on timed deep breathing have used the yogic concept of pranayama as a conscious internal awareness of the whole breathing process. Further, most research on the immediate effects of pranayama has used a nonclinical, healthy sample, while research on the therapeutic benefits of pranayama has focused on long-term benefits from regular practice. This study was undertaken to determine the immediate effects of 5 minutes of a classic pranayama technique, sukha pranayama, on cardiovascular parameters in hypertensive patients attending the Yoga Out Patient Department at JIPMER, Puducherry, India.

Methods

This study was conducted at the Advanced Centre for Yoga Therapy Education and Research (ACYTER). ACYTER is a collaborative venture between Morarji Desai National Institute of Yoga in New Delhi and the Jawaharlal Institute of Postgraduate Medical Education & Research in Puducherry, with funding from the Department of Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homeopathy (AYUSH) in the Ministry of Health and Family Welfare, Government of India. Ethical approval was obtained by ACYTER from the Institutional Ethics Committee for studies on the effect of yoga therapy on hypertension and diabetes. The present study was conducted as a pilot study as part of this larger study on the effects of yoga therapy in patients with hypertension.

Participants

Twenty-three patients (11 men) with essential hypertension attending the Yoga Out Patient Department (OPD) ran by ACYTER were selected for this study by nonrandom sampling. The Yoga OPD is a facility of ACYTER where patients are referred from various departments of the hospital to be given yoga consultation. Individualized and group-based yoga therapy schedules are determined based on their condition. These schedules are then completed at the ACYTER Yoga Hall. Regular follow-up is done on a periodic basis at the Yoga OPD, and required changes made in the schedule as appropriate. Participant age ranged from 45 to 70 (M = 55.13, SEM = 1.54) years. All of the participants had experienced hypertension for more than 5 years and were under regular medical management with one or more antihypertensive medications at the Medicine OPD in JIPMER. Patients of secondary hypertension and those with history, signs and symptoms, or laboratory reports suggestive of nephrologic, neurologic, and ophthalmologic complications were excluded from the study. None of the participants had any previous experience of yoga training before attending the Yoga OPD. Informed consent was obtained by one of the investigators.

Pranayama Intervention

Participants were taught to perform sukha pranayama in an individual manner by a qualified yoga teacher working as a yoga instructor in ACYTER. Sukha pranayama is a simple type of yogic breathing that is done by consciously regulating
the inhalation and exhalation to an equal ratio, with internal awareness of the complete breathing process involving all sections of the lungs. This pranayama can be done at the rate of 6 breaths/min by using a timed count of 5 for inhaling and exhaling. The study was done in the third session of attendance at ACYTER, after the practice had been taught in the first two sessions. In these preliminary sessions, participants were also introduced to simple breath–body co-ordination and loosening practices, along with savasana relaxation.

An overview of the practice was given to the patients, and then they were instructed to sit upright, resting their palms on their thighs. They were asked to keep their eyes closed to facilitate the development of an internal awareness. The pranayama was done through both nostrils in a calm and regular manner with a conscious effort to use the lower, middle, and upper parts of the lungs in a sequential manner for both inhalation and exhalation. Participants were instructed to breathe in and out for an equal count of 5 that was given by the instructor using a stopwatch. The instructor called out counts at the rate of 6 breaths/min for the entire duration of 5 minutes.

**Measurements**

Heart rate (HR) and blood pressure (BP) were measured using a noninvasive semi-automatic blood pressure monitor. Baseline measurements of HR and BP were taken after 5 minutes of rest in a seated posture. HR and BP were measured again after the 5 minutes of sukha pranayama. Pulse pressure (PP) was calculated as SP-DP, mean arterial pressure (MAP) as DP + 1/3 PP, rate-pressure product (RPP) as HR × SP/100, and double product (Do P) as HR × MAP/100. Statistical analysis was done using a student’s t-test for paired samples. P values less than .05 were accepted as indicating significant differences between the baseline and post-pranayama means.

**Results**

All values are given as mean ± SEM. Immediately following 5 minutes of deep breathing, there was a statistically significant (p < .05) fall in HR from 79.3 ±2.86 to 76.57 ±2.69 beats /min. The SP fell from 136.13 ± 3.32 to 126.96 ± 2.54 mm Hg (p < .001), MAP from 97.26 ± 1.78 to 92.81±1.49 mm Hg (p < .001), RPP from 108.50 ± 5.25 to 97.82 ±4.58 units (p < .001), and Do P from 77.34 ± 3.31 to 71.34 ± 3.04 units (p < .001). PP showed a significant fall from 58.3 ± 2.95 to 51.22 ± 2.22 mm Hg (p < .01), while there was a statistically insignificant fall in DP from 77.83 ±1.48 to 75.74 ±1.32.

According to the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure, normal systolic pressure (SP) and diastolic pressure (DP) are expected to be less than 120 mm Hg and 80 mm Hg, respectively. SP between 120–139 mm Hg and DP between 80–89 mm Hg is labelled as prehypertension, while SP values above 140 mm Hg and DP above 90 mm Hg are considered stage I hypertension. SP more than 160 mm Hg and DP more than 100 mm Hg is considered stage II hypertension (JNC VII).

**Discussion**

In the present study, the practice of sukha pranayama for 5 minutes at a rate of 6 breaths/min was found to reduce the heart rate and blood pressure in patients with hypertension. Although both systolic and diastolic pressure dropped, only the reduction in systolic pressure was significant. This may be because systolic values were initially already higher than is considered healthy. On the other hand, diastolic pressure was already within the normal range. Because sukha pranayama aims to produce a balanced state, further drops would not be expected. The cardiovascular effects were more pronounced with regard to the MAP, RPP, and Do P. RPP and Do P are especially significant because they are indicators of myocardial oxygen consumption and load on the heart. The decrease observed following sukha pranayama implies a lowering of strain on the heart itself. The observed changes may in part be due to an increase in parasympathetic activity and decrease in sympathetic activity, which has been previously reported in a study of pranayama’s effects on ventricular performance.

The beneficial cardiovascular effects seen in this study may also be due to the rate of breathing. Studies by Prakash and colleagues and Ravindra and colleagues have shown the therapeutic benefits of deep breathing at the rate of 6 breaths/min on reducing premature ventricular complexes. The authors suggested that this was possibly due to the increased vagal modulation of sinoatrial (SA) and atrioventricular (AV) nodes. The increase in vagal modulation may be responsible for the reduction in heart rate and blood pressure seen in this study. It has been previously suggested that breathing at 6 breaths/min has the effect of entraining all RR interval fluctuations, thereby causing them to merge at the rate of respiration and to increase greatly in amplitude. This increase in RR interval fluctuations enhances baroreflex efficiency and may have contributed toward lowering blood pressure.

The slow, deep, conscious breathing done in sukha pranayama may also help normalize autonomic cardiovas-
cular rhythms that were described by Mayer more than a century ago. These rhythms occur as a 10-second cycle in blood pressure that is related to both vagal and sympathetic activity. Luciano Bernardi and colleagues have shown beneficial effects of rosary prayer and yoga mantras in restoring these autonomic cardiovascular rhythms. They reported an increase in baroreflex sensitivity following such chanting and concluded that rhythm formulas that involve breathing at six breaths/min induce favorable psychological and possibly physiological effects. A previous study by Joseph and colleagues reported a normalization of baroreflex sensitivity in hypertensive patients following just 2 minutes of breathing at the rate of 6 breaths/min.

We conclude that *sukha pranayama* when performed at the rate of 6 breaths/min is effective in reducing heart rate and blood pressure in hypertensive patients after just 5 minutes of practice. This finding has potential therapeutic applications in day-to-day as well as clinical situations where blood pressure needs to be brought down quickly. It is simple, cost-effective, and may be added to the management protocol for hypertensive patients in addition to the regular medical management of such situations. Further studies are required to enable a deeper understanding of the mechanisms involved. We plan to further investigate how long the cardiovascular effects persist, as this will provide more information about its usefulness in the long-term management of hypertension.

References