

An evaluation of the effect of Pranayamas and Transcendental meditation on high blood pressure subjects: A non-blinded randomized controlled trial

Ranjan Dixit^{1,*}, Trilok Ranjan Srivastav², Monica Dixit³

¹Associate Professor, ²Professor, Dept. of Physiology, Govt. Medical College, Azimgarh, Uttar Pradesh, ³Tutor, Dept. of Biochemistry, Rama Medical College, Kanpur, Uttar Pradesh

***Corresponding Author:**

Email: ranjan_dixit1980@yahoo.co.in

Abstract

Objective: To evaluate the effect of Pranayamas and Transcendental Meditation on high blood pressure among the patients of eastern part of Uttar Pradesh.

Materials and Method: This was a non-blinded randomized controlled study. The subjects received training thrice a week. A total of 51 subjects completed the training (Group A-17, Group B-17, Group C-17). The subjects of Group A received Pranayamas programme, Group B received the Transcendental Meditation programme and Group C (Control group) received no training. Blood pressure, heart rate and respiratory rate were taken in the beginning and at the end of the training (at 12 weeks).

Results: There was significant effect of both Pranayamas and meditation in cardiovascular parameters. No significant difference was observed in the cardiovascular parameters between Group A and Group B at 12 weeks.

Conclusion: The practice of Pranayamas and meditation revealed a significant change among high blood pressure subjects. However, the studies on larger sample size are required.

Keywords: Pranayamas, Meditation, Cardiovascular Parameters

Introduction

The hypertension has been considered the most important risk factor for coronary heart disease, stroke, congestive heart failure, end-stage renal disease and peripheral vascular diseases.⁽¹⁾ Worldwide, hypertension accounts the major part of morbidity and mortality due to cardiovascular diseases (CVD).⁽²⁾ World Health Organization (WHO), CVD will be the important cause of mortality and morbidity in India by 2020 and nearly half of this mortality will be in young and middle-aged subjects.⁽³⁾

Pranayamas have been define as practice of breathing control so that breathing become slow and smooth. The gape between inhalation and exhalation has been eliminated because of that mind and concentration is under control.⁽⁴⁾ Pranayamas has been derived from two Sanskrit words, first, prana, means vital force and second, ayama means to prolong.⁽⁵⁾

Transcendental meditation (TM) has been type of meditation which dwell on a series of words (called mantra) provided by the meditation teacher without effort. If the attention wanders, it is allowed to wander till it returns to the mantra.⁽⁵⁾

The purpose of this study was to evaluate the effect of Pranayamas and Transcendental Meditation on high blood pressure among the patients of eastern part of Uttar Pradesh.

Materials and Method

This was a non-blinded randomized controlled study conducted at a tertiary care hospital in eastern part of Uttar Pradesh over a period 12 weeks in connection with a spiritual center in the district. The

study got permission by the ethical committee of the college. The consent from each subject was taken before involving in the study. Sixty subjects between the group 40-55 years included in the study and randomly divided into 3 groups (20 in each group) by using random number table generated from computer. The subjects received training twice a week. A total of 51 subjects completed the training (Group A-17, Group B-17, Group C-17).

The subjects of Group A got Pranayamas training, Group B received the Transcendental Meditation training and Group C (Control group) was not involve in any training programme. All parameter B.P, Respiratory Rate, each of the subject were taken in the beginning and at the end of the training (at 12 weeks).

The blood pressure (BP) [systolic and diastolic blood pressure (SBP and DBP)] of the subjects was obtained by Auscultatory method. Pulse rate of the subjects was obtained by using simple Watch method. The mean arterial blood pressure (MAP) was calculated as $MAP = DBP + 1/3 (SBP - DBP)$.

The demographic data such as age, sex and anthropometric parameters were recorded for each subject. A particular mantra was provided separately to all the subjects of experimental group A and Group B.

After that experimental groups was given preparatory speech then conducted PUJA (worship) of Guru. Followed by Puja, the subjects of experimental groups A and B practiced the programme for 30 minutes starting with a silence of half minute finishing it with a silence of two minute in Lotus like sitting position with closed eyes.

Group A was done selected Pranayamas for 45 minutes thrice a week and practice sessions were

conducted. For teaching purpose, each Pranayamas was explained briefly and demonstrated before the subjects performed the same. Essential corrections were made, the rest of instructions were given in between succeeding Pranayamas. Subjects sit in Padmasana and Sukhasana position with spine in an upright position with eyes closed.

Group B was done procedure of Transcendental Meditation which involves the repetition of Mantra for 30 minutes thrice a week while the meditators seat in lotus like position with eye closed. First, the meditators pointed out the most comfortable position for themselves, one which allowed the spine to be in an upright position either in lotus like sitting position on the floor or in a straight backed chair with feet firmly planted on the ground with eyes closed.

One start with taking a few deep and well modulated breaths to calm down and then proceeded to the sub-vocal repetitions of the Mantra or Special sound.

The subjects of control group were asked to sit quietly with eyes closed in Lotus like position.

Statistical analysis: The results are presented in mean±SD and percentage. The discrete variables were

tested for normalcy by using Kolmogorov-Smirnov Z test and found to be normal. The gender difference among the three groups was compared by Chi-square test. The cardiovascular parameters and anthropometry were compared by one way analysis of variance among the groups followed by Turkey's post-hoc comparison tests. The intra-group comparison from baseline to 12 week was done by Paired t-test. The average percent change was calculated as (Baseline value-12 week value)/Baseline value X 100. Significant value of $p < 0.05$ was observed. All the analysis were carried out on SPSS 16.0 version (Chicago, Inc. USA).

Results

Table 1 shows the baseline characteristics of the study subjects. The mean age of the subjects was similar among the groups ($p > 0.05$). More than half of the subjects of Group A (57.8%), 67.7% of Group B and 50% of Group C were males, the difference was statistically insignificant ($p > 0.05$). The anthropometric parameters were also similar among the groups ($p > 0.05$). The cardiovascular parameters were observed to be similar among the groups ($p > 0.05$).

Table 1: Baseline characteristics of the group subjects

	Group A	Group B	Group C	p-value ¹
Age in years	51.52±7.47	51.38±7.26	50.56±7.26	0.92
Male gender, no. (%)	10 (59.8)	12 (67.7)	8 (51.0)	0.61
Height in cms	160.06±3.47	159.42±4.19	158.94±4.25	0.72
Weight in kgs	67.44±5.90	67.40±5.75	67.61±6.03	0.99
BMI (Weight/m ²)	26.35±2.71	26.57±5.75	26.81±2.91	0.89
SBP (mmHg)	146.40±1.69	146.21±1.83	146.11±1.74	0.88
DBP (mmHg)	98.05±4.02	98.88±4.80	98.74±3.87	0.83
HR (beats/min.)	86.81±3.79	86.66±3.72	87.37±3.42	0.84
RR (/min.)	89.75±3.19	89.27±2.84	90.00±3.16	0.78
MAP (mmHg)	114.16±2.39	114.65±3.05	114.53±2.27	0.84

¹ANOVA test

There were significant difference ($p > 0.05$) among the groups in SBP at 12 week. The post-hoc tests revealed that SBP was significantly ($p = 0.0001$) lower among the subjects of Group A (128.06±3.86) and Group B (127.83±3.77) compared to Group C (143.88±2.30). Similar observation was found for DBP, HR, RR and MAP at 12 week. There were no significant difference in the cardiovascular parameters between Group A and Group B at 12weeks (Table 2).

Table 2: Comparison of Cardiovascular parameters among the groups at 12weeks

	Group A	Group B	Group C	p-value ¹
SBP (mmHg)	129.05±3.86 ^a	128.82±3.77 ^b	144.87±2.30 ^{a,b}	0.0001*
DBP (mmHg)	85.00±3.10 ^a	84.55±3.86 ^b	97.61±3.87 ^{a,b}	0.0001*
HR (beats/min.)	75.28±1.26 ^a	74.93±1.16 ^b	86.18±3.27 ^{a,b}	0.0001*
RR (/min.)	78.58±3.41 ^a	77.55±1.79 ^b	89.55±3.36 ^{a,b}	0.0001*
MAP (mmHg)	105.46±2.13 ^a	105.10±2.48 ^b	113.78±2.29 ^{a,b}	0.0001*

¹ANOVA test, Values are in mean±SD, ^{a,b} $p = 0.0001$ (Tukey's post-hoc test test), *Significant

Table 3 shows the comparison of mean change in cardiovascular parameters within the groups from baseline to 12 weeks. A significant ($p = 0.0001$) decrease was observed in cardiovascular parameters from baseline to 12 weeks

among the subjects of Group A and Group B. However, the decrease in the cardiovascular parameters from baseline to 12 weeks among the subjects of Group C was found to be statistically insignificant ($p > 0.05$).

Table 3: Comparison of mean change in Cardiovascular parameters within the groups from baseline to 12weeks

	Group A		Group B		Group C	
	Mean change	p-value ¹	Mean change	p-value ¹	Mean change	p-value ¹
SBP (mmHg)	17.34±4.56	0.0001*	17.38±4.40	0.0001*	1.25±1.69	0.06
DBP (mmHg)	13.04±4.47	0.0001*	14.33±4.88	0.0001*	1.12±1.02	0.07
HR (beats/min.)	11.51±4.30	0.0001*	11.72±4.08	0.0001*	1.18±1.16	0.06
RR (beats/min.)	11.16±4.50	0.0001*	11.77±3.49	0.0001*	0.43±0.62	0.09
MAP (mmHg)	8.71±2.98	0.0001*	9.55±3.25	0.0001*	0.75±0.68	0.08

¹Paired t-test, Values are in mean±SD, *Significant

Fig. 1 depicts the average percent change in cardiovascular parameters among the groups from baseline to 12 week. The average percent change in the cardiovascular parameters from baseline to 12 week was observed to be higher in Group A and Group B compared to Group C. However, the average percent change was found to be almost similar in Group A and Group B.

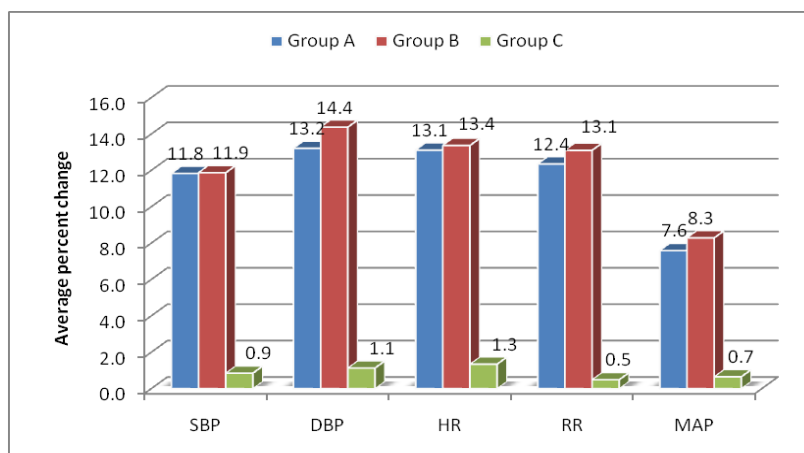


Fig. 1: Average percent change in cardiovascular parameters among the groups from baseline to 12 weeks

Discussion

Breath movement has been change by pranayamas. Body and mind have been act like bridge of breath. Breath has three phases: *Purak* (inhalation), *Kumbhak* (retention), and *Rechak* (exhalation) which can be practiced in either slow or fast manner.⁽⁶⁾

As a Practice, Pranayamas have been suppose to be the complex forms of breathing. But the main thing of the practice is slow and deep breathing. Slow breathing causes a generalized decrease in the excitatory pathways regulating respiratory and cardiovascular systems. Similar control mechanism have been observed for respiratory and cardiovascular systems, change in one system will modify the functioning of the other.⁽⁷⁾ During slow and deep breathing, lung inflates to the maximum extent so that pulmonary stretch receptors are stimulated which lead to removal of sympathetic tone in skeletal muscle blood vessels bring to generalised vasodilatation and decrease in peripheral resistance and thus decrease diastolic blood pressure.⁽⁸⁾ During Pranayamas practice we concentrates so that we

are free from stress and worries and this will lead to relaxe responses in mind because of that parasympathetic nerve activity superimpose on sympathetic activity.⁽⁹⁾

Meditation can decrease state of anxiety which one way reduces sympathetic over activity this will lead to decrease in arterial tone and peripheral resistance which bring lowering of diastolic blood pressure and heart rate.⁽¹⁰⁾ Practice of yoga, regularly had been revealed improvement in baroreceptor reflex sensitivity and decrease in the sympathetic tone so that restoring blood pressure to normal level in patients of essential hypertension.^(11,12)

The results of this study proved that there were no significant difference in the baseline parameters such as age, gender, anthropometric and cardiovascular parameters. Therefore, all the three groups were found to be comparable which was in agreement with the study conducted by Dinesh et al.⁽⁶⁾ Our study observed that both Pranayamas and Meditation practices had

significant effect on cardiovascular parameters compared to controls.

In the present study, we founded a highly significant reduction in SBP, DBP, HR and RR might be contributed to the change of the autonomic activity with parasympathetic predominance and relatively reduced sympathetic tone. This autonomic change in Pranayamas and meditation is bring through change of breathing patterns which modify various central and autonomic mechanisms and also mechanical and hemodynamic adjustments causing both tonic and phasic changes in cardiovascular functioning.⁽¹³⁾ A study conducted by Chintamani et al revealed a significant decrease in heart rate and systolic blood pressure while diastolic blood pressure did not show any significant change after 10 weeks of Pranayamas among healthy subjects.⁽¹⁴⁾ Another prospective, study of Yogender et al controlled, open trial showing angiographically proved coronary artery disease patients revealed yoga-based lifestyle changes caused regression of coronary lesions and in improving myocardial perfusion which was translated into clinical benefits and symptomatic improvement.⁽¹⁵⁾ A study conducted by Mody et al, six healthy Asian Indian men and women (18–22 years) who were trained in Surya namaskar for over 2 years observed that regular practice of Surya namaskar might maintain or improve cardiorespiratory fitness as well as promote weight management.⁽¹⁶⁾

A study of 50 healthy male subjects of 18–25 years of age group, subjected to Mukh Bhastrika (yogic bellows), a type of Pranayamas breathing training for 12 weeks conducted by Veerabhadrappa et al demonstrated that an increase in parasympathetic activity, means, reduced basal heart rate, increase in valsalva ratio and deep breathing difference in heart rate; and reduction in sympathetic activity, that is, decrease in fall of systolic blood pressure on posture variation.⁽¹⁷⁾ Study of Cheema et al, in a parallel-arm RCT, 67 sedentary office workers subjected to a 10-week, office-based yoga program conducted during lunch hour showed improve in resting heart rate variability (HRV) and related physical and psychological parameters.⁽¹⁸⁾

In our opinion, very few studies have been programmed on the subjects above 40 years because these people are very prone for cardiovascular diseases. In the present study, we are trying to fulfill these deficiency.

Also, present study tried to sorted out the effects of Pranayamas and meditation practices in decreasing blood pressure, it also observed that whether these changes persist after getting normal respiration or long term practice will lead to stable change of cardiovascular control.

Limitation of the study

1. Sample size was relatively small

2. Only age group 40-50yrs are included

Conclusion

The practice of Pranayamas and meditation reveal a significant reduce in heart rate and systolic blood pressure among high blood pressure subjects.

Conflict of interest

None

Funding

None

References

1. Park K. Epidemiology of communicable diseases. Textbook of Preventive and Social Medicine. 19th ed. Jabalpur: Banarsidas Bhanot; 2007. p. 310-3.
2. Schoen FJ. Blood vessels. In: Kumar V, Abbas AK, Fausto N, editors. Robbins and Cotran Pathologic Basis of Disease. 7th ed. India: WB Saunders Company; 2005. p. 525-6.
3. Goyal Rajni, Lata Hem, Walia Lily, Narula Manjit K. Effect of Pranayamas on rate pressure product in mild Hypertensives. International Journal of Applied and Basic Medical Research, Jul-Dec 2014, Vol 4, Issue 2.
4. Taneja DK. Yoga and health. Indian J Community Medicine 2014;39:68-72.
5. Tandon OP. Yoga and its applications. In: Tandon OP, Tripathi Y, editors. Best and Taylor's Physiological Basis of Medical Practice. 13th ed. Gurgaon: Wolters Kluwer health/Lippincott Williams and Wilkins publishers; 2012. p. 1217-30.
6. Dinesh T, Gaur G S, Sharma V K, Madanmohan T, Harichandra Kumar K T, Bhavanani A B. Comparative effect of 12 weeks of slow and fast Pranayamas training on pulmonary function in young, healthy volunteers: A randomized controlled trial. International J. Yoga 2015;8:22-6
7. Joseph CN, Porta C, Casucci G, Casiraghi N, Maffei M, Rossi M, et al. Slow breathing improves arterial baroreflex sensitivity and decreases blood pressure in essential hypertension. Hypertension 2005;46:714-8.
8. Upadhyay Dhungel K, Malhotra V, Sarkar D, Prajapati R. Effect of alternate nostril breathing exercise on cardiorespiratory functions. Nepal Medical College J 2008;10:25-7.
9. Subbalakshmi NK, Saxena SK, Urmimala, Urban JAD. Immediate effect of nadishodhana Pranayamas on some selected parameters of cardiovascular, pulmonary and higher functions of brain. Thai J. Physiology Science 2005;18:10-6.
10. Vyas R, Dikshit N. Effect of meditation on respiratory system, cardiovascular system and lipid profile. Indian J of Physiology and Pharmacology 2002;46:487-91.
11. Murugesan R, Govindarajulu N, Bera TK. Effect of selected yogic practices on the management of hypertension. Indian J Physiology and Pharmacology 2000;44:207-10.
12. Damodaran A, Malathi A, Patil N, Shah N, Suryavanshi, Marathe S. Therapeutic potential of yoga practices in modifying cardiovascular risk profile in middle aged men and women. J Association of Physicians India 2002;50:633-40.
13. Raghuraj P, Ramakrishnan AG, Nagendra HR, Telles S. Effect of two selected yogic breathing techniques on heart

- rate variability. *Indian J Physiology and Pharmacology* 1998;42:467-72.
14. Chintamani Dilip Bodhe, Deepali Sadashiv Jankar. Effects of short term Pranayamas on certain cardiovascular risk factors. *International Journal of Biomedical Research*, 2015;6(2).
 15. Yogendra J, Yogendra HJ, Ambardekar S, Lele RD, Shetty S, Dave M, *et al.* Beneficial effects of yoga lifestyle on reversibility of ischaemic heart disease: Caring heart project of International Board of Yoga. *J. Association of Physicians India* 2004;52:283-9.
 16. Mody BS. Acute effects of Surya Namaskar on the cardiovascular & metabolic system. *J Bodyw Mov Ther* 2011;15:343-7.
 17. Veerabhadrapa SG, Baljoshi VS, Khanapure S, Herur A, Patil S, Ankad RB *et al.* Effect of yogic bellows on cardiovascular autonomic reactivity. *J. Cardiovascular Disease and Research* 2011;2:223-7
 18. Cheema BS, Marshall PW, Chang D, Colagiuri B, Machliss B. Effect of an office worksite-based yoga program on heart rate variability: A randomized controlled trial. *BMC Public Health* 2011;11:578.