



Effect Of 12 Weeks Yoga Training And 12 Weeks Detraining on Blood Pressure Subjects with Hypertension

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Article History	Abstract
Received: 06 June 2023 Revised: 05 Sept 2023 Accepted: 20 Oct 2023	Background: Hypertension, an early predictor of cardiovascular disease can be prevented by healthy lifestyle modification. Stress-induced disorders such as hypertension can be effectively managed with the holistic science of yoga. Objective: In hypertensive individuals who are receiving routine treatment, we investigated the effects of yoga training for 12 weeks and compare as well as analyze these parameters at the end of yoga training (12th week) and after 12 weeks of follow-up with hypertensive on regular treatment (non-yoga group). Materials and methods: The study involved randomly assigned 124 hypertensive subjects to either experimental or control groups where N=65, and the yoga groups where n=61 between age of 25 to 45 years were included. In both the yoga group and the control group, heart rates (HR), Systolic Blood Pressures (SBP), Diastolic Blood Pressures (DBP), Pulse Pressures (PP), Mean Arterial Pressures (MAPs), and mean arterial pressure products were recorded before, after, and during the study period. Results: The means of RPP, HR, PP, SBP, MAP and DBP of pre-post, and follow-up values of the control group were compared by RM ANOVA and also there was no significant difference were found that exists among the groups. The mean values in the test group of post-training and follow-up show a significant decrease when compared with pre-training values. There are a significant decrease in test group follow-up values and post-training compared with follow-up values of control group and post-training respectively. In test group follow-up values the significant increase is found when compared with the test group post-training. Conclusion: Yoga reduced HR, SBP, DBP, PP, MAP, and RPP in essential hypertension under resting conditions. Reduced Sympathetic Activity, Enhanced Vagal Modulation and the increased sensitivity of baroreflex might be responsible for the harmonization of autonomic cardiovascular rhythms. Detraining from yoga, on the other hand, did not result in an increase in blood pressure. In conclusion, the present study shows that regular practice in yoga is helpful in reducing the hypertension, and that deep rest keeps the body healthy. Keywords: Hypertension, yoga, parasympathetic tone, sympathetic activity
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1. Introduction

High Blood Pressure or Hypertension is a widespread health issue that affects a notable portion of the world population. It can bring about severe complications in cardiovascular and other health-related

problems if left uncontrolled. Modern human beings are victim for non-communicable disease such as diabetes and hypertension and their associated complications. As a result of hypertension, both developed and developing countries suffer from early morbidity and mortality [1]. It has been reported that young Indians are more likely to have hypertension and prehypertension [2,3,4] and that almost one in three Indian adults has hypertension between the ages of 20 and 44 years [5].

The Blood Pressure is under control for 10% of rural patients and 5% of urban Indian hypertensive patients while the remaining have uncontrolled hypertension due to lack of awareness and poor socio-economic backgrounds [6]. Management of hypertension includes anti-hypertensive drugs and adjuvant therapy such as lifestyle modifications, healthy dietary habits, practicing exercise and good sleep habits to enhance psychosomatic relaxation [7]. One such approach that has gained considerable attention is yoga—a holistic mind-body practice that incorporates physical postures, breathe control, and meditation to promote overall well-being.

Yoga is the best style ever designed, easy to practice by all kind of people, originated in India and practiced by almost all parts of the world. Regular practice of yoga produces deep psychosomatic relaxation and enhances cardiovascular health [8,9,10]. Practicing yoga makes a person to combat the stress better than the normal population [11]. A 12-week yoga training program was tested on hypertensives taking routine medications and to compare and analyze these parameters at the end of yoga training (12th week) and after 12 weeks of follow-up with hypertensives on regular treatment (non-yoga group) on cardiovascular parameters.

The present study aims to examine the subjects with Blood Pressure who were diagnosed along with hypertension after the training program of yoga by 12 weeks. During this intervention phase, participants will engage in regular yoga practice under the supervision of trained instructors. The study seeks to explore whether consistent yoga practice can lead to a remarkable reduction in the levels of Diastolic Blood Pressure and Systolic Blood Pressure, potentially offering a safe and non-pharmacological means of managing hypertension. Furthermore, understanding the sustainability of the benefits gained from yoga training is crucial. To address this aspect, the study will also include a 12-week detraining period during which participants will discontinue their yoga practice. This detraining phase will allow us to observe any regression or persistence of the blood pressure changes achieved during the training phase.

2. Materials And Methods

From Mahatma Gandhi Medical College and Research Institute (MGMCRI), Puducherry., the Hypertensive patients were recruited from the Department of Medicine Outpatient (OPD) who were aged between 25-45 years of From Subjects with Alcoholic or nicotinic dependence, Morbid obesity, Acute illness, Patients on steroids, drugs modulating autonomic nervous system and antipsychiatry drugs (antidepressants) were excluded on the basis of medical history. The subject were randomized to generate an allocation sequence by block randomization after obtaining the consent and to allocate the subjects a technique called Serially Numbered Opaque Sealed (SNOSE) is applied either to yoga or control group.

In MGMCRI, between the duration 8 a.m. to 10 a.m. the parameters were collected from the subjects are recorded in the Research lab of Physiology Department. The subjects were asked to come with an empty bowel and blood pressure was recorded before their antihypertensive drug. The Sphygmomanometer is used to obtain the Systolic and Diastolic Blood Pressure of subjects after giving a rest of 15 min in supine. With the intervals of 5 min, the calculation are done from the average of three trials. The formula $PP = SBP - DBP$ is used to actuate the Pulse Pressure. Then RPP and MAP were actuated by using $RRP = (SBP \times HR)/100$; $MAP = DBP + (PP/3)$. The parameters are taken before and after 12 weeks of the yoga training and then follow-up after 12 weeks of the yoga group and similarly parameters were recorded for the control group also.

Intervention (12 weeks):

The OPD in MGMCRI prescribed the antihypertensive drugs and it is received by both the groups of subjects. In addition to therapy of drug, the approved yoga therapy is received by the yoga group. The Centre for Yoga Therapy Education and Research (CYTER) approves the therapy given to the Yoga

groups which is located in Sri Balaji Vidyapeeth, Puducherry by following the guidelines of a trained Yoga teacher of Morarji Desai National Institute of Yoga (MDNIY). There were 45 minutes of yoga therapy sessions for three days in a week for the yoga group and motivated them to continue the same for remaining days of a week at home. There will be attendance register for the sessions of yoga therapy, and the data related were obtained from those subjects who has at least 70% of attendance. To assess the effect of detraining of intervention after the periods of 12 weeks for the yoga group, On the other hand control group not received yoga therapy.

Elements of Yoga Therapy:

The classes normally start with a cursory prayer for 5 Min and the preliminary practices like joint loosening exercises and breath-body coordination for 10 Min followed by Module for yoga training (table 1) adopted from the study done by Punitha et al 2016.

Table 1: Module for Yoga therapy

1	Yogic Comforting	
2	Preliminary Practices	Coordination for the practice of Breath-body and joint loosening exercises
3	Asans or fixed Postures	Talasan, Ardhakati chakrasan, Ardha chakrasan, Uttanpadasan, Ardha halasan, Pavanmuktasan, Makarasan, Bhujangasan and Vajrasan
4	Pranayam or Techniques for Breathing	Shavithri, Chandra Nadi, Pranav and Nadi shuddhi pranayama
5	Techniques for Relaxation	Shavasan with savitri pranayama

3. Results and Discussion

The SPSS version of 16.0 is used to analyze the data obtained statistically and shown and it is shown in table 2. All data was passed the normality test by Shapiro-Wilk, Unpaired students t-test was used for intergroup analysis, and Repeated measure ANOVA (RM ANOVA) was used for intra-group comparisons.

Table 2. Effect of 12 weeks yoga practice followed by 12 weeks detraining on RPP, HR, PP, SBP, MAP and DBP on hypertensive patients

Parameters	Control (N= 63)			Yoga (N= 61)		
	Pre	Post	Detrain	Pre	Post	detrain
HR	77.63 ± 4.87	77.8 ± 3.51	78.4 ± 3.23	81.94 ± 4.56	75.29 ± 4.11 ^{###**}	80.01 ± 5.21*
SBP	135.14 ± 7.52	134.44 ± 6.21	134.51 ± 5.42	137.38 ± 9.21	129.77 ± 8.38 ^{####***}	133.57 ± 6.64**
DBP	90.76 ± 6.11	88.70 ± 5.97	88.57 ± 5.07	90.36 ± 6.30	87.93 ± 5.38 ^{####***}	88.46 ± 6.51*
PP	44.38 ± 4.65	45.75 ± 5.35	45.94 ± 5.36	47.02 ± 4.21	41.84 ± 5.04 ^{###**}	45.11 ± 5.26*
MAP	105.56 ± 6.24	103.95 ± 5.50	103.88 ± 4.54	105.67 ± 7.12	100.54 ± 6.09 ^{####***}	103.50 ± 11.07**
RPP	106.66 ± 14.37	104.99 ± 13.89	105.102 ± 13.3	110.38 ± 14.33	100.81 ± 4.17 ^{####***}	103.16 ± 13.65**

• SBP- Systolic Blood pressure, DBP- Diastolic blood pressure, PP- Pulse pressure, MAP- Mean arterial pressure, RPP- Rate pressure product.

• *p < 0.05; **p < 0.01; ***p < 0.001 comparison within the group with pretraining; #p < 0.05; ##p < 0.01; ###p < 0.001 comparison between post control and post yoga group.

The means of SP, DP, PP, MAP, and RPP of pre, post, and detraining values of the control group were compared by RM ANOVA and it was found that also there is no significant difference exists among the groups. In test group, the mean values of post-training and follow-up show a significant decrease when compared with pre-training values. There are a significant decrease in test group post-training and follow-up values when compared with post-training and follow-up values of control group values respectively. There are a significant increase in test group follow-up values when compared with test group post-training.

The study has a purpose to analyze the effects of yoga intervention on SBP, DBP, PP, MAP, and RPP in patients with hypertension during the period of pre-training of yoga, after 12 weeks of yoga training (Post-training), and after 12 weeks detraining (follow-up) from the yoga training for yoga group. It was found that 12 weeks of yoga training significantly decrease SBP, DBP, PP, MAP, & RPP in hypertensive subjects. Conversely, it was increased after 12 weeks of detraining from the yoga practices of the yoga group. Similar findings were done by Punitha et al [12], who proposed that yoga reduces SBP, DBP, and MAP after post-training 12 weeks of yoga. On the other hand, it was found that there were no significant changes in the control groups during pre, post, and follow-up.

By maintaining sympathetic tone, DBP is one of the primary measures of peripheral vascular resistance. Sympathetic tone can explain significant decreases in DP. A relaxation technique such as pranayama reduces mental anxiety, resulting in decreased arterial tone and peripheral resistance, reduction in Diastolic Blood Pressure and Heart Rate, and an improving circulation in peripheral [13]. An increase in parasympathetic activity was noted in heart rate and blood pressure [14, 15], suggesting a shift in balance in the autonomic nervous system. The limbic system and higher areas of the central nervous system may have modulated autonomic nervous system activity via yoga's effects on autonomic functions. The practice of yoga reduces blood pressure in patients with essential hypertension by increasing baroreflex sensitivity and reducing sympathetic tone [17-20].

Yoga practices reduce the RPP, indicating decreased oxygen consumption and heart work, which result in decreased blood pressure in this study and other studies [22-24]. As cholinesterase and catecholamine levels are reduced by yoga, sympathetic activation is reduced, and parasympathetic activation increases [24, 25]. On the other hand, detraining from practice of yoga for 12 weeks showssignificantly increase compared with post training values, which shows that, the effect of yoga is not sustained after detraining yoga practice. According to this findings, regular practicing of yoga has a significant positive result, conversely declining after detraining from practicing yoga.

This study found that yoga practice enhances parasympathetic activity and decrease sympathetic activity on cardiovascular parameters. This might be the reason for the decrease in resting BP in our study. As in the Hering Breuer reflex, yoga practice is hypothesized to increase the frequency and duration of inhibitory neural impulses. Reduced sympathetic activity following yoga training leads to reduced catecholamine secretion, which allows for vasodilation and better peripheral circulation [22]. As a result of stopping sympathetic tone to skeletal muscle, peripheral resistance is decreased, resulting in a reduction in blood pressure. Conversely, detraining from yoga might progressively decrease parasympathetic activity or enhance sympathetic activity by decreasing the duration and frequency of inhibitory neural impulses by the “Hering Breuer reflex”.

4. Conclusion

As a result of the practice of yoga in essential hypertension, SBP, DBP, PP, MAP, and RPP were consistently decreased at rest. Enhanced vagal modulation and reduced sympathetic activity may have played a role in harmonizing autonomic cardiovascular rhythms in conjunction with a boost in endogenous nitric oxide production. Detraining from yoga, however, did not result in elevated blood pressure. The current study indicates that regular yoga practice promotes healing of hypertension, deep rest is preferential for the whole body, and this effect is maintained even after detraining.

The dilation of blood vessels, oxygenated pure blood is offered to the various organs of the body, enabling the organs to be renovated, healed, and maintained in good health. Additionally, this reduces mental tension, enhances readjustments, and increases prana supply while practicing yoga. Yoga practice aid to reduce stress and enhance energy and reharmonize the endocrine chakra complex and also helps in readjusting the lifestyle and strengthening the whole body-mind complex. According to

our study findings, yoga reduces age-related deterioration in cardiovascular function in patients with mild to essential hypertension, as well as chronic hypertension. Incorporating yoga practices into our current lifestyles would certainly enhance their efficacy and add value. Yoga therapy can be used as an effective method for harmonizing or centralizing standard medical treatment of essential hypertension depending on the extent of the program.

Additional Information

Disclosures

Human subjects: obtained informed consent from all subjects in this study. The Institutional Human Ethics Committee, Mahatma Gandhi medical college & research institute, Sri Balaji Vidyapeeth, Pondicherry, India, issued approval Project No Ph. D/2016/03/08. Animal subjects: It has been confirmed by all authors that animal subjects were not used in this study. Conflicts of interest: The following is a summary of all authors' disclosures according to the ICMJE uniform disclosure form: Payment/services info: It has been declared by all authors that the submitted work was free from any financial support. Financial relationships: In addition to declaring that they have no financial relationship with any organizations that may be interested in their work, all authors have disclosed financial relationships within the previous three years. Other relationships: The authors declare that the submitted work is not influenced by any other relationships or activities.

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