

Effect of Yoga Intervention in the Management of Hypertension: A Preventive Trial

Abstract

Background: Noncommunicable diseases are on the rise in India. Hypertension is one of the major risk factors for cardiovascular diseases and also labeled as a chronic lifestyle disorder. Hence, non-pharmacological interventions leading to lifestyle modifications are of utmost importance to control and prevent hypertension. This trial aims to implement yoga intervention to the experimental group in addition to medicines, advice on diet and physical activity and to compare blood pressure and perceived stress scores with the control group. **Methods:** It was an open-label, two-armed, non-randomized controlled trial, conducted at a tertiary care center on 145 patients with hypertension: 73 in the intervention group and 72 in the control group. The intervention group received yoga intervention for a period of 4 months on a weekly basis along with advice on physical activity, diet, and routine medicines. The control group did not receive yoga intervention. **Results:** The mean age of the participants was 51.3 ± 9.4 , females (58.2%) outnumbered males (41.3%). Following the intervention, perceived stress score and blood pressure showed a significant reduction between two groups ($P < 0.001$). Also, perceived stress and blood pressure were found to be reduced significantly within both groups ($P < 0.001$). **Conclusions:** Yoga proves to be an effective, safe, and less expensive adjunct therapy for hypertension management. Yoga was also found to be effective in reducing the level of stress. Diet modification and physical activity have got an important role to play in the control and prevention of hypertension.

Keywords: Hypertension, noncommunicable diseases, yoga

Introduction

Noncommunicable diseases (NCDs) are on a rise globally and in India. They are key barriers to poverty alleviation and sustainable development.^[1] Hypertension is one of the risk factors for cardiovascular morbidity and mortality. It is estimated to have caused 9.4 million deaths and 7% of disease burden as measured in disability-adjusted life years in 2010.^[2]

Hypertension is labeled as a lifestyle disorder because of the contribution of modifiable risk factors in its development, that is, obesity, unhealthy diet (high intake of saturated fatty acid and salt, low intake of fruits, vegetables, dairy products), physical inactivity, stress, harmful use of alcohol, and smoking.^[3] Addressing these lifestyle issues is the need of the hour.

Yoga is an ancient naturopathy in India. Yoga is derived from a Sanskrit word “Yuj” means to “unite,” to unite the mind and body. There are many traditional

schools of yoga which include Jnana Yoga, Bhakti Yoga, Karma Yoga, Patanjala Yoga, Kundalini Yoga, Hatha Yoga, Dhyana Yoga, Raja Yoga, etc., Each school has its own approach. Hatha yoga which includes physical postures (asana), controlled breathing (pranayama), and meditation (*dhyana*) is used in the trial.^[4]

The age-old Indian practice of yoga is known to help reduce stress and likely to reduce blood pressure. In the era of evidence-based medicine, it is important to generate data to support this claim. Hence, a trial was conducted to assess the effectiveness of yoga intervention within prehypertensive and hypertensive patients.

The primary objective of the trial was to compare the conventional intervention which is the standard treatment guideline with planned yoga intervention in addition to standard treatment. The outcome variables were a reduction in blood pressure reading and perceived stress score. The secondary objectives were to study

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the sociodemographic profile and risk factors with special reference to stress.

Methods

It is an open-label, two-armed, non-randomized controlled trial conducted using an experimental study design in 2016. The trial was registered in the Clinical Trial Registry of India (CTRI/2017/09/009841).

The target population was selected from a tertiary level hospital of a metropolitan city from the outpatient department (OPD) dedicated to hypertensive patients. The sample size was calculated using the standard deviation of systolic blood pressure (SBP) of hypertensive patients as 10, with a 5% level of significance and power of study 80%.^[5] The expected reduction in SBP after the intervention was assumed to be 5 mm Hg. Assuming a dropout rate of 20% sample size estimated was 75 in each group. The total sample size was 150. Out of 150 participants, five were lost to follow-up as they had moved to their native place. The final sample size for analysis was 145 of which 73 were in the intervention arm and 72 were in control arm. Participants aged 25 and above, both male and female gender, and participants having blood pressure <160 systolic and <100 diastolic irrespective of the treatment status were included in the trial. Pregnant females, stage-II and malignant hypertension, and patients with serious complications were excluded.

Institutional ethics committee approval obtained on 4th April 2016. Written informed consent was taken prior to data collection.

Participants who fulfilled the inclusion criteria were enrolled by sequential enumeration method, in batches of 10–20 and further allocated into two groups: intervention and control group. All participants were hypertensive and on medication for the past 1 year. None of the prehypertensives agreed to come for an intervention.

Intervention in the trial involves lifestyle modifications that require logistics and participant's convenience; hence, true randomization was not possible. Matching for age, sex, and baseline blood pressure, that is, blood pressure at the time of enrolment was done. Blood pressure was measured in the right arm in the sitting position with a mercury sphygmomanometer by the auscultatory method.

After building rapport, baseline data of participants of both groups were collected by one-on-one interviews of all participants using a pretested case record form. The stress level of participants was measured by using 10 items five-point Likert perceived stress scale.^[6]

After enrolment and baseline data collection, small groups of 3–6 study subjects were made, and a talk was given about basic knowledge of disease in simple language using a flipchart. The control group received dietary advice and advice on physical activity along with drug treatment.

The experimental group was given drug treatment, dietary advice, advice on physical activity, and yoga intervention. Yoga practices were taught to participants on a weekly basis, by an experienced yoga teacher, in a separate hall in the hospital campus. Participants were encouraged to do yoga at home daily for 4 months, as taught in these yoga sessions.

Intervention

Drug treatment

Study participants of both groups were on a prescribed antihypertensive medication by a qualified physician.

Dietary advice

Advice about healthy diet, that is, frequency of meals (3–4 small meals per day), food items to be preferred (e.g., salad, sprouts, legumes, whole grains, fruits, vegetables, nuts, red meat, fish) and to be avoided (e.g. fried food, pickle, sauce, *papad*, sweets, packaged food), reduction in daily salt consumption up to less than 5 g per day (about one teaspoon) was given to both groups. Food habits, availability, feasibility, and cultural acceptability of food items by participants were taken into consideration. Cessation of smoking and reduction in alcohol consumption was also encouraged.

Advice on physical activity

Study subjects were asked to take a brisk walk (walking at a speed which can cover 100 steps in a minute) in the nearby garden every day for 30 min at any suitable time preferably in the morning or evening. Those who cannot walk for 30 min at a stretch were advised to start slowly and increase their activity gradually. Participants were encouraged to walk for at least 5 days a week.

Yoga intervention

Yoga package consists of selected yoga postures (asanas), meditation (*dhyana*), and breathing exercises (pranayama). Standard textbooks of yogic practices, a standard course recognized by Yoga Vidhya Niketan, Government of Maharashtra,^[7] and The Common Yoga Protocol^[8] released by the Ministry of AYUSH, Government of India were referred for planning the yoga package. Asanas found to be effective in hypertension and stress reduction were selected.

Yoga trainer (qualified from Kaivalyadham Institute, having 25 years of experience in this field) was also involved in planning the yoga package. The final yoga plan was validated by experts, trained as a yoga teacher, in the department.

Yoga session started with a set of asanas (*Ardha-halāsana*, *Ardha-pavanmuktāsana*, *Bhujangāsana*, *Makarasana*, *Paschimattanasana*, *Vakrasana*, *Parvatasana*, *Chakrasana*), each asana to be repeated twice and to be maintained for 20 s each. Approximately it required 10–15 min to do

these set of asanas. This was followed by pranayama for 3–5 min, followed by Shavasana for 3–5 minutes. The yoga session ended with meditation for 3–5 min. One such yoga session took around 20–30 min.

A compliance chart was given to participants of both groups, containing columns showing their respective intervention activity. They were asked to tick mark the chart every day and bring it at the time of follow-up every month. Participants who performed yoga at home and followed diet advice and physical activity for at least 5 and >5 days a week or 20 or more days in a month were considered as compliant toward the intervention.

The follow-up of all participants was done monthly. Repeated phone call reminders were sent to keep in touch with participants and which helped maintain their follow-up. Though participants were regular attendees of OPD, health talk using flipcharts, compliance charts, and phone call reminders for the next visit helped to reduce the dropout rate.

Data were entered in Microsoft Excel and analysis was done using IBM SPSS Software version 22. A Chi-square test was used for categorical variables to compare the baseline characteristics of participants in two groups. Independent sample *t*-test and Mann-Whitney U test were used to compare variables between the intervention and control group. Paired *t*-test and Wilcoxon's signed-rank test was used to compare variables within the groups.

Results

The sociodemographic profile of participants and risk factors of hypertension in intervention and control arms were comparable [Table 1]. There were a greater number of females than males because coming for intervention on a weekday was more suitable to females as compared to males due to their work. Around 17.2% of participants were vegetarian and 82.8% were taking a mixed diet. All participants were taking cereal grains and legumes in their regular meals. Although the frequency of consumption of unhealthy food, that is, deep-fried, food with extra salt, and fast food was found to be less, only 14% had included healthy food, that is, fruits and vegetables in their diet more frequently.

When comparing mean of outcome variables within the group (before and after intervention) using paired *t*-test [Table 2] mean weight ($P < 0.001$), mean body mass index (BMI) ($P < 0.001$), mean systolic and mean diastolic blood pressure ($P < 0.001$), and using Wilcoxon's signed ranked test, median perceived stress score ($P < 0.001$) was found to be significant in both intervention and control arm.

Following the intervention, there was a reduction of median perceived stress score by 11 in intervention and 7 in the control arm. There was a reduction of 7 mmHg in mean SBP and 5.3 mmHg in mean diastolic blood pressure (DBP) in the intervention arm. There was a reduction of 3.8 mmHg in mean SBP and 2.4 mmHg in mean DBP in the control arm. Both modalities have

Table 1: Sociodemographic profile and distribution of risk factors of participants

Sociodemographic Variables		Intervention group <i>n</i> =73 (%)	Control group <i>n</i> =72 (%)	Total <i>n</i> =145 (%)	Chi-square (<i>P</i>)
Age group (years)	25-35	2 (2.7)	3 (4.2)	5 (3.4)	0.603
	36-45	17 (23.3)	9 (26.3)	36 (24.8)	
	46-55	27 (36.9)	31 (43)	58 (40)	
	56-65	23 (31.5)	14 (19.4)	37 (25.5)	
	>66	4 (5.5)	5 (6.9)	9 (6.2)	
Gender	Males	32 (43.8)	28 (38.9)	60 (41.3)	0.545
	Females	41 (56.2)	44 (61.1)	85 (58.2)	
Marital status	Married	60 (82.2)	60 (83.3)	120 (82.8)	0.104
	Single/widowed/divorced	13 (17.8)	12 (16.7)	25 (17.2)	
Family type	Nuclear	44 (60.3)	47 (65.3)	91 (62.8)	0.129
	Joint	16 (21.9)	20 (27.8)	36 (24.8)	
	Three generation	13 (17.8)	5 (6.9)	18 (12.4)	
Socioeconomic class (Modified Kuppusswamy Classification) ^[9]	Upper class	2 (2.7)	0	2 (1.4)	0.229
	Upper-middle class	26 (35.6)	29 (40.3)	55 (37.9)	
	Lower-middle class	39 (53.4)	32 (44.4)	71 (49)	
	Upper-lower class	6 (8.2)	11 (15.3)	17 (11.7)	
Risk factors					
Family history of hypertension		17 (23.3)	9 (12.5)	26 (17.9)	0.177
Diabetes mellitus as comorbidity		11 (15.1)	14 (19.4)	25 (17.2)	
Addiction to alcohol/chewing tobacco/smoking		7 (9.6)	14 (19.4)	21 (14.5)	
Unhealthy diet for more than four times a week		7 (9.6)	5 (6.9)	12 (8.3)	
Obesity (BMI >30)		13 (17.8)	19 (26.4)	32 (22.1)	

caused a statistically significant reduction in blood pressure and stress scores [Table 3]. However, the effect in the intervention arm is greater than the control arm, which can be attributed to yoga intervention. Although there was a reduction in mean weight and BMI after intervention in both the groups, it was not found to be statistically significant between the groups (intervention and control group).

It was found that 58 (79.5%) out of 73 in the intervention arm had good compliance toward the intervention and 15 (20.5%) did not comply with intervention. In control group, 38 (52.8%) out of 72 complied with the advice whereas 34 (47.2%) had poor compliance.

Discussion

Hypertension management and good control of the blood pressure not only requires medical treatment but also lifestyle modification. A small reduction in the average blood pressure of the whole population by a mere 2 or 3 mmHg would produce a large reduction in the incidence of cardiovascular complications.^[2] It is estimated that a 5 mmHg reduction of SBP in population would result in a 14% overall reduction in mortality due to stroke, a 9% reduction in mortality due to coronary heart disease.^[10] Thus, any population-based approach which can decrease the blood pressure level in the general population by even modest amounts has the potential to reduce morbidity and mortality or delay the onset of hypertension.

A systematic review showed that yoga has a modest but significant effect on reducing blood pressure especially incorporating three basic elements of yoga practice (postures, meditation, and breathing).^[4] Another

review reported that yoga effectively reduces blood pressure in both normotensive and hypertensive populations. But heterogeneity of yoga practice and lack of evidence about its long-term effects makes it difficult to recommend any specific yoga.^[11] Another review reports the effectiveness of yoga as a treatment of hypertension which is encouraging but inconclusive.^[12]

This trial showed a positive effect of yoga in reducing the blood pressure of hypertensive individuals. Perceived stress score, SBP, and DBP were found to be significantly reduced after intervention with yoga practice. Other trials also reported similar findings.^[5,13] A trial reported that *anuloma-viloma* pranayama and breath awareness significantly reduces blood pressure.^[14] Another trial reported a significant reduction in blood pressure in both intervention and control groups with a similar yoga plan as in this study.^[15]

Studies have reported a yoga program causing a significant reduction in mean stress score, BMI, and blood pressure in hypertensive individuals and a significant reduction in BMI in obese individuals.^[16,17]

It was realized during the trial that adopting a healthy lifestyle was not a priority of individuals. High level of motivation and a strong behavioral change communication is, therefore, required so that a healthy lifestyle including physical activities like yoga is adopted as a cultural practice by society. A review article suggests that increased physical activity and cardiorespiratory fitness reduce cardiovascular disease mortality, and both resistance and aerobic exercises are beneficial in improving physical fitness. Also, continuous and interval physical fitness training both showed a reduction in blood pressure.^[18]

Table 2: Outcome measures and P values within the groups

Outcome Variables	Intervention group			Control group		
	Before intervention	After intervention	Paired sample t-test (P)	Before intervention	After intervention	Paired sample t-test (P)
Median perceived stress score	22	11	<0.001*	22	15	<0.001*
Mean weight (kg)	66.9±11.9	64.4±11.4	<0.001	66.7±10.7	65.7±10.4	<0.001
Mean BMI (kg/m ²)	26.7±4.2	25.7±4.1	<0.001	27.2±4.0	26.7±3.9	<0.001
Mean SBP (mmHg)	132.3±6.6	125.3±6.1	<0.001	133.5±5.9	129.7±4.9	<0.001
Mean DBP (mm Hg)	86.1±5.2	80.8±3.5	<0.001	85.6±5.3	83.1±3.9	<0.001

*Wilcoxon's signed-rank test. BMI: body mass index; SBP: systolic blood pressure; DBP: diastolic blood pressure

Table 3: Outcome measures and P values between the groups

Outcome variables	Before intervention			After intervention		
	Intervention group	Control group	Independent sample t-test (P)	Intervention group	Control group	Independent sample t-test (P)
Median perceived stress score	22	22	0.548*	11	15	<0.001*
Mean weight (kg)	66.9±11.9	66.7±10.7	0.892	64.4±11.4	65.7±10.4	0.490
Mean BMI (kg/m ²)	26.7±4.2	27.2±4.0	0.520	25.7±4.1	26.7±3.9	0.125
Mean SBP (mmHg)	132.3±6.6	133.5±5.9	0.220	125.3±6.1	129.7±4.9	<0.001
Mean DBP (mm Hg)	86.1±5.2	85.6±5.3	0.550	80.8±3.5	83.1±3.9	<0.001

*Mann-Whitney U test

Conclusions

This trial was able to implement a structured intervention for hypertensive patients. Simple practices such as yoga should be made available to the population at no additional cost. Yoga can be part of apex medical institutes. More counseling sessions by health care workers would help improve compliance. Although, this will put an extra burden on health care an effort where yoga becomes a lifestyle of people is worth the resources put in. Yoga should become a culture in society so that youngsters and kids get influenced and adopt a healthy lifestyle at an early age.

The future of NCD's management is an integrated intervention. There is a need for a holistic health unit to manage NCDs including diabetes mellitus, hypertension, and obesity by an integrated approach. Trials on a larger scale are required to demonstrate the effect of non-pharmacological interventions to strengthen its evidence in control of hypertension.

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Conflicts of interest

There are no conflicts of interest.

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