

Effect of Yoga and Meditation on Mild to Moderate Essential Hypertensives

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ABSTRACT

Introduction: Hypertension is the most common cardiovascular disease affecting more than one billion people throughout the world. More than 95% of hypertensives belong to essential type, having no particular cause. By treating hypertension and factors contributing to it, both mortality and morbidity can be reduced. The objective of this study is to evaluate the effect of yoga and meditation on mild to moderate essential hypertensive patients.

Methods: These patients were divided in to two groups: (a)15 patients treated with antihypertensive drugs along with

yoganidra, (b)15 patients on antihypertensive drugs alone. Yoganidra practiced for 45min daily in the morning and evening. Parameters were recorded at the beginning and again at the end of 3 months.

Results and Conclusion: The study showed a significant fall of mean blood pressure after 3 months of yoganidra ($p < .01$). Results of this study suggest that yoganidra can be used as adjunctive treatment with drug therapy on mild and moderate essential hypertensives.

Key Words: Anti-hypertensive drugs, Blood pressure, Essential hypertension, Yoga-nidra

INTRODUCTION

Hypertension is the most common cardiovascular disease affecting more than one billion people throughout the world. It is a major contributor of stroke, ischaemic heart disease, heart failure, renal dysfunction and blindness. It is directly responsible for 57% of all stroke deaths and 24% of all coronary heart disease deaths in India [1].

A precise definition of hypertension is difficult to establish as blood pressure is a continuous variable and has a skewed normal distribution with in the population. However the seventh Joint National Committee on Detection, Evaluation, and treatment of high blood pressure (JNC VII 2003) defined hypertension as a systolic blood pressure (SBP) of 140mmHg or greater and diastolic blood pressure (DBP) of 90mmHg or higher. It has proposed various categories in the classification of Hypertension based on severity of disease process.

Category	SBP (mmHg)		DBP (mmHg)
Normal	<130	and	< 85
High normal	130 – 139	or	85 – 89
Stage I (mild)	140 – 159	or	90 – 99
Stage II (moderate)	160 – 179	or	100 – 109
Stage III (severe)	> 180	or	> 110

[Table/Fig-1]: Classification of Hypertension

Hypertension is further classified into two groups based on the aetiology as it is essential or primary hypertension and secondary hypertension. Essential hypertension is diagnosed when there is strong family history and no identifiable cause can be found.

More than 95% of hypertensives belong to essential type of unknown aetiology and only few have identifiable cause, belonging to secondary type. By treating hypertension and factors contributing

to it, both mortality and morbidity can be reduced.

Hypertension is a lifelong condition that is usually treated easily but difficult to keep under control. Drugs belonging to major classes such as Angiotensin converting enzyme inhibitors, beta blockers, calcium channel blockers, diuretics, alpha receptor antagonists are prescribed appropriately depending on the degree of hypertension. But, many hypertensives require two or more drugs of different combinations to control blood pressure. This may lead to adverse drug interactions and side effects. The chief side effects include dry cough, pedal edema, fatigue, frequent urination, insomnia, impotence, postural and post-prandial hypotension.

In the treatment of hypertension, side effects and the patient's perception of them play an important role in success of therapeutic regimen. Distressing side effects of drugs affect health related quality of life of patients, often leading to non-adherence of therapy. Moreover, anti-hypertensive drug treatment may be costly and in fact, only few people manage to keep their blood pressure under control. Hence, controlling of hypertension by life style modifications are highly recommended either as a primary prevention or as therapy with or without drugs. Unfortunate diet and exercise per se have rarely been effective in the long term control of high blood pressure.

There is a growing body of research on new non-drug treatment modalities such as Yoga and Meditation in controlling blood pressure. Evidence supporting its use as alternative therapy is accumulating. Yoga and meditation are relaxation techniques which are non-invasive, easy to practice, cost-effective interventions which do not have any appreciable side-effects or symptoms.

Although scientific studies support the use of yoga and meditation in treatment of hypertension exist, it has not been standardized and fully recognized or endorsed by medical professionals. Therefore it is imperative to conduct further research on efficacy of yoga and

meditation in the treatment of essential hypertension.

AIMS AND OBJECTIVE

Essential Hypertension leads to permanent harmful changes in blood flow to many organs and also places a burden on the Left Ventricle. Usually, these patients are treated with drugs.

The effect of Yoga and Meditation (Vajrasana, Sukhasana, Shavasana, pranayama, "om" Meditation and Yoganidra) on blood pressure has been studied to explore the possibility of reducing the drug dosage and thus eliminating harmful side effects.

MATERIALS AND METHODS

The effects of yoga and meditation on essential hypertension was studied in thirty subjects in the age group of 45 – 65 yrs under medication. The Case history regarding period of hypertension, family history, duration of drug therapy, type and dosage of drugs, history of allergy, personal history was obtained. As baseline, all participants underwent a comprehensive medical examination, haematological and bio-chemical investigations to exclude secondary hypertension. The baseline parameters such as Body Mass Index (BMI), lipid profile, fasting and post-prandial blood glucose, type and dosages of drugs taken were recorded in all subjects before starting the study. Approval from ethical committee and consent from patients was obtained. Eligible participants were selected and stratified into two groups using the following selection criteria:-

Group I : (cases)

Fifteen hypertensives treated with drugs along with yoga intervention programme

Group II: (controls)

Fifteen hypertensives only on anti-hypertensive drug therapy without yoga practice

Inclusion Criteria

- males and females of 45 – 65 yrs of age
- body mass index in the range of 18 – 28.8 kg/m²
- mild to moderate essential hypertensives with systolic 140-179mmHg and diastolic 90-109mmHg (JNC VII)
- essential hypertensives under anti-hypertensive therapy
- no other complications revealed by biochemical, haematological and urine analysis tests

Exclusion Criteria

- secondary hypertension of any aetiology
- uncontrolled diabetes mellitus
- thyroid disorders
- alcohol habituation
- BMI < 28.8
- grossly abnormal liver/kidney function tests or significant cardiovascular complications

The subjects of group I were selected from Yoga and Meditation Center at Universal World Peace Divine Empire, Kodambakkam, Chennai 24. Initially, 40 subjects were screened for group I, out of which 28 subjects were selected according to the above mentioned selection criteria. Nine subjects were excluded due to non-compliance of yoga therapy and fifteen subjects completed the study. This group comprised of 8 men and 7 woman with mean age of 54.33yrs. The duration of hypertension ranged from 1-20 yrs with mean of 3.66 yrs. All fifteen were

on anti hypertensive medication out of which two were taking anxiolytics in addition.

The Blood Pressure was measured in selected subjects using mercury sphygmomanometer in supine, sitting and in standing positions before starting their yoga practice. The study was conducted for three months from first week of September to last week of November 2007. The subjects under group I were strictly monitored to attend yoga classes daily for at least five days a week.

The programme consisted of:

- vajrasana and pranayama for 5 minutes
- sukhasana and "om" meditation for 5 minutes
- shavasana and yoganidra for 45 minutes.

Technique of Yoga Nidra

Yoga nidra is a kind of meditation and relaxation technique practiced in a semi-darkened room. Yoga nidra is done by first starting with yoga posture vajrasana (sitting in kneeling pose), followed by pranayama- (alternate nostril breathing) for five minutes. Later, the subjects are seated in sukhasana (normal sitting posture) and asked to chant "om" for three times with deep concentration.

Then, the subject lies in the supine position and practices shavasana (corpse pose) with lower limbs 30 degrees apart and the upper limbs making an angle of 15 degrees with the trunk, with the forearms in the mid-prone position and fingers semi-flexed. The eyes are closed with eyelids drooping. The subject is taught to slow, rhythmic diaphragmatic breathing with a short pause after each inspiration and a longer one at the end of each expiration. After establishing this rhythm, he is asked to pay attention to the sensation at the nostrils, the coolness of the inspired air and the warmth of the expired air. This procedure helps to keep the subject inwardly alert and to forget his usual thoughts, thus becoming less conscious of the external environment, thereby attaining relaxation. The subject is asked to relax all muscles so that he is able to feel the heaviness of different parts of the body. This is achieved automatically once the subject learns the exercise. An experienced master checks that there is no movement of any part of the body, except rhythmic abdominal movements. Physical relaxation is checked from time to time by lifting extremities and letting them go to observe their flaccidity. Yoganidra is done by asking the subject to concentrate on the different parts of the body in a prescribed sequence. This way, they try to arouse different parts of the brain by concentrating on the matching parts of the body.

Initially, the subject has to shift his concentration quickly from one part to the next corresponding to the instructions given by the instructor in the following sequence. First, on right side, thumb, fingers, palm of hand, wrist, forearm, elbow, arm, shoulder, right back, hip, thigh, knee, leg, ankle, foot, great toe, other toes of right foot. The same sequence is repeated for the left side. Then, the concentration is focussed on the proximity of body with ground and next on the front of the body surface. Then the subject is asked to shift his consciousness again on breathing at the nostrils completing physical relaxation. Then the subject is asked to visualise the objects of universal significance as described by the instructor. The practice usually takes 45min to 50 min to complete and is followed by the instructions given to the subjects to gently massage their body parts one by one before sitting up.

The programme schedule was between 6.30 am – 7.30 am in morning and from 5.30–6.30 pm in the evening. The instructions regarding yoga and meditation was provided to the participants by well trained yoga master.

The controls were selected from routine hypertension out patient clinic. Thirty subjects were initially screened, out of which fifteen subjects satisfying the selection criteria were selected. This group comprised eight male and 7 female with mean age of 53 yrs. The duration of hypertension ranged from 1-20yrs with mean of 4.56 yrs. All fifteen were on Anti- hypertensive drugs with three subjects on added anxiolytics and two on anti-cholesterol drugs.

The subjects were excluded if they were practicing yoga or any other form of stress reduction techniques. The blood pressure was recorded after half an hour's rest in supine, sitting and standing positions. These readings were taken as pre-trial blood pressure.

Both the subjects of group I and group II were not asked to change their drug and dosage during the study period. The lipid profile of group I and group II was recorded at the beginning of the study.

Measurements

The effect of yoga therapy was studied using the following parameters:

- systolic blood pressure
- diastolic blood pressure
- pulse rate
- peak expiratory flow rate
- lipid profile
- BMI
- 12-lead ECG

Blood Pressure Measurement in Supine, Sitting and Standing Position

The blood pressure was measured indirectly by auscultation as described in 1902 by N.S. Korotkoff, using stethoscope and mercury sphygmomanometer. The latter includes a standard sized cuff and mercury column pressure gauge. The blood pressure was measured initially by palpatory method in which radial pulse obliteration was used to estimate Systolic Pressure. The cuff was then inflated 20mm Hg above this level for auscultatory determination.

The brachial artery was first palpated in the ante-cubital fossa and its pulsation felt. The cuff was then wrapped around the upper arm with the lower end of the cuff placed about 2 to 3 cm above the fossa. The stethoscope was placed over the brachial arterial pulsation and the cuff was inflated above the estimated systolic pressure. Then the cuff was deflated slowly at a rate of 2- 3 mm/Hg per second. The Korotkoff sounds phase I was recorded as systolic and phase V was recorded as diastolic blood pressures. Initially, the blood pressure was measured on both arms and higher of the two readings was taken as systolic blood pressure.

The subjects of yoga group were asked to stay in supine position after yoganidra and the blood pressure was recorded with the cuff wrapped around the upper arm, supported with a pillow at the level of heart. The subject was then allowed to rest on a chair for few minutes and the blood pressure was recorded in sitting position. The blood pressure was again recorded in the standing position for three minutes.

The procedure was repeated in control group where the supine blood pressure was measured after resting for five minutes. Later, the sitting and standing blood pressure was also recorded. The blood pressure was measured every month for both the groups till the end of third month. Simultaneously, the pulse rate in sitting position was also recorded.

Measurement of PEFR

Peak Expiratory Flow Rate was recorded using mini Wright peak flow meter. The flow rates were measured in both the groups during the first and last weeks of the study period. The subjects were asked to exhale forcefully in one single blow into the instrument after taking a deep breath. The procedure was repeated three times and the average of three was recorded.

ECG Measurement

The resting 12-lead ECG was recorded once before the study from both the groups and this was repeated once again after three months. The Resting heart rate and height of R wave was measured from the recorded ECG.

Lipid Profile

Venous blood sample was collected from both the groups in the morning after an overnight fast of 12 hours and the serum was used for estimating total cholesterol (TC), triglycerides (TG) and High density lipoprotein (HDL-C). Total cholesterol and Triglyceride concentrations was determined by enzymatic methods. HDL-C was determined following the removal of triglyceride rich lipoprotein and Low Density lipoprotein (LDL-C) using the HDL-direct liquid select TM kit. LDL cholesterol was calculated using Friedwald formula: $LDL-C = TC - HDL - (TG/5)$. The above parameters were estimated before commencement of the study and again repeated after three months.

BMI

Body mass index was calculated twice during first and third month using the formula:

$$BMI = \frac{\text{Weight (kg)}}{\text{Height (m)}^2}$$

Materials

- Mercury Sphygmomanometer
- Stethoscope
- Proforma
- information sheet
- Mini-Wright peak flow meter
- 12-lead Electrocardiograph

Statistical Analysis

In all the groups, the parameters named above were measured at the beginning of The study and again at the end of 3 months study period. The data was analysed using paired "t"-test to compare the pre and post values of each group separately in order to detect the changes produced by yoga intervention. In the present study, $P < .01$ was considered to be the level of significance.

Changes in ECG

Left ventricular hypertrophy due to systemic hypertension was indicated by the height of 'R' wave in lead I, aVL, V5 and V6 in electrocardiogram. The height of 'R' wave was taken prior to yoga

practice and three months after continuation of yoga practice. Out of 15 patients, the height of 'R' wave had come down appreciably in some patients along with reduction of systemic hypertension.

RESULTS

B.P in mm of Hg		pre	Post 1	Post 2	Mean diff
Supine	Syst	151.33±14.1	140.8±12.9	132.4±18.1	18.9
	Diast	90.67±9.6	85.07±9.6	76.93±9.6	13.73
Sitting	Syst	151.47±10	138.27±11	129.33±16.3	22.13
	Diast	92.8±8.5	86.4±8.8	78.8±7.8	14.00
Stand	Syst	145.2±9.6	134.67±9.7	128.67±11.9	16.53
	Diast	100.27±8.9	94.53±9.5	85.73±7.3	14.53
Pulse rate in bts/min		76.07±6.5	71.93±7.3	67.53±5.1	8.5b/min

[Table/Fig-2]: Mean values of study cases

B.P in mm of Hg		pre	Post 1	Post 2	Mean diff
Supine	Sys	154.26±16.2	142.93±18.2	144±22.4	10.26
	Dias	87.06±5.5	84.13±8.5	82.8±7.7	4.26
Sitting	Sys	151.73±11.4	139.46±15.2	140.66±18.1	11.06
	Dias	93.73±6.5	88±8.7	88.26±6.2	5.46
Stand	Sys	139.46±11.3	128.93±15.8	133.6±18.2	5.87
	Dias	93.33±10.5	89.6±11.4	90.26±10.2	3.07
Pulse rate in bts/min		76.20±9.5	72.07±8.0	74.67±13.4	1.53

[Table/Fig-3]: Mean values of controls

As shown in [Table/Fig-2 and 3], there is significant reduction of supine systolic blood pressure from (151.33 ± 14.1)mm of Hg to (132.4±18.1) mm of Hg. The supine diastolic pressure showed decrease after yoga practice from (90.67±9.0) mm of Hg to (76.93±9.6) mm of Hg. The systolic blood pressure in standing position decreased significantly from (145.2 ± 9.6) mm Hg to (128.67±11.9) mm Hg and the diastolic pressure reduced from (100.27±8.9) mmHg to (85.73±7.3) mmHg. The systolic blood pressure in sitting position reduced from (151.47±10) mm Hg to (129.33±16) mmHg. The diastolic pressure showed reduction after yoga practice from (92.80±8.5) mmHg to (78.8± 7.8) mm Hg. The pulse rate showed mean difference of 8 beats/min after yoga intervention.

The paired t test results showed significant reductions in pulse rate, supine, sitting and standing blood pressures after yoga intervention. There was no difference were seen in LDL-C and HDL -C in cases before and after intervention. Total cholesterol and triglycerides showed improvement in yoga group, but showed less significance compared to controls. There was little change in peak flow rates after 3 months yoga practice.

DISCUSSION

Essential Hypertension is a multifactorial disease in which arterial pressure is persistently high without an identifiable cause. The pathogenesis of essential hypertension is not fully understood. Blood pressure is mainly dependant on cardiac output and total peripheral resistance. The possible mechanism are believed to be sympathetic nervous system overactivity and consequent increase in peripheral vascular resistance. In addition, direct pressor effect by the sympathetic nervous system and catecholamines released

from the adrenal medulla may also be involved. Hypertrophy of systemic arterioles may represent an adaptive response to chronically elevated blood pressure and may perpetuate systemic hypertension. Inappropriately high sympathetic nervous outflow from central nervous system is also believed to be an important component in the pathophysiology of acute and chronic essential hypertension which in turn increases cardiac output and peripheral resistance.

Regulation of blood pressure is normally an involuntary process controlled by sympathetic nervous system and hypothalamus. Stimulation of posterior and lateral parts of hypothalamus activates the sympathetic nervous system. Repeated sympathetic stimulation via hypothalamus has been shown to produce sustained systemic hypertension. The cerebral cortex can be trained to influence the blood pressure. This effect is likely to be mediated through the hypothalamus. Hypothalamus is also closely related to limbic system which plays an important role in emotional and instinctual behaviour. Since many manifestations of emotional changes like anger involve sympathetic responses, all these parts of the brain are likely to have some effect on the blood pressure. Stress too is likely to influence blood pressure through these pathways. Since, cerebral cortex is necessary for all voluntary actions, voluntary reduction of stress may be achieved by training the cerebral cortex. An indicator of stress is blood pressure. Many studies have shown reduction of blood pressure after meditation [2,3,4].

The EEG is a record of the electrical activity of the cerebral cortex. When the mind is active, the EEG shows desynchronisation i.e , frequent and random activity. At certain times, it shows wave like activity i.e, synchronisation. The presence of waves has been shown to indicate coordinated activity between thalamus and cerebral cortex. Alpha wave pattern is seen in an adult human at rest, with mind wandering and eyes closed. It is also seen just before a person falls asleep. It has a frequency of 8-12/sec. Other regular wave patterns are theta waves and delta waves. They have frequencies of 4-7/sec and less than 4/sec respectively. Theta waves occur in children and are shown to be generated in hippocampus (a part of limbic system) in experimental animals. Delta waves usually occur during deep sleep.

Several EEG studies have shown sleep like changes during meditation with increased alpha activity in the beginning and theta activity towards the end of meditation practice [5,6,7]. Recent EEG studies on yoganidra showed similar results with alpha wave patterns with theta wave patterns occurring at later stages [8]. Generally wave like activity occurs during relaxation (alpha waves) and during deep sleep (delta waves). Alpha rhythm in meditation and yoganidra is an expected finding under these circumstances. But appearance of theta waves may indicate deep cortex induced relaxation in an awakened subject.

During stress the sympathetic nervous system becomes activated and the organism shows the 'fight or flight' response. In normal circumstances, the parasympathetic system takes over after the emergency and is mainly active during sleep. But mostly it has been seen that the sympathetic system remains active during most of the daytime resulting in the experience of distress [9]. In yoganidra an attempt is made to activate the parasympathetic system, and slowly a new balance between the sympathetic and parasympathetic systems is achieved by inducing complete physical, emotional and mental relaxation. In this way, the practice of yoganidra reduces stress.

In this study, there is a significant decrease seen in pulse rate of about 8 beats/min after practicing Yoganidra for 3 months. In similar studies, Wallace et al [10] on meditation alone, reported reduction of 5 beats/min while Bagga and Gandhi [11] showed reduction about 15 beats/min after practicing shavasana and meditation. This reduction of pulse rate is attributed to a decrease in sympathetic activity and increase in parasympathetic activity.

In the present study, there is greater reduction seen in mean blood pressure of 18.9/13.7 mmHg in supine, 22/14 mmHg in sitting and 16.5/14.5 mmHg in standing positions. Stone and Deleo [12] observed a mean blood pressure reduction of 9/8 mmHg in supine and 15/10 mmHg in standing positions after practicing meditation alone for 6 months. They also found decrease in Dopamine Beta Hydroxylase enzyme and plasma renin activity in meditators indicating the reduction of chronic adrenergic activity. Early studies by Barnes et al [13] on meditation reported significant reduction in mean systolic blood pressure and found improvement in cardiovascular performance of meditators. In this study the reduction in mean systolic and diastolic blood pressure is found to be more than that obtained by meditation alone.

In one patient in the study group, the ECG showed improvement in left ventricular function following significant reduction in systemic blood pressure. The decreased systolic pressure can be attributed to the relaxation of mind produced as a result of yoganidra, which reduces stress and discharge of sympathetic nervous system. A decrease in diastolic pressure is most likely to be due to relaxation techniques that patient has gradually learnt which finally resulted in peripheral vasodilation.

Various studies on hypertensives after shavasana, a kind of yoga therapy, showed reduction of blood pressure. This reduction is found to involve diastolic blood pressure more than systolic blood pressure [14,15]. This is likely to be due to its predominant action on muscles alone, without involving the state of mind. This is confirmed by Ather Ali et al [16] who analysed various mind body techniques and reported that yoga therapy alone showed significant reduction of diastolic blood pressure while there was a greater reduction seen in mean systolic blood pressure after practicing yoga and meditation.

Yoganidra is a meditation and relaxation technique which has its action more on mind than on the physical body. Its principal action on the mind may bring down the sympathetic activity and thereby reduce hypertension. The present study showed that in mild to moderate hypertensives on drug therapy, addition of yoganidra produced significant reduction in blood pressure. This reduction is more than that obtained by meditation alone. Since, the study was for 3 months, further studies involving a bigger group for prolonged periods is likely to show long term beneficial effects of this technique.

As quoted by Andrews et al, [17] a clinically important reduction in mean B.P is defined as a decrease in excess of 10 mm of Hg in 3 months or more after treatment. Recent trials on various non-drug therapies showed mind body therapies such as yoga, muscle relaxation and meditation to be significantly effective in reducing blood pressure. In the present study on yoga nidra, there is significant reduction of mean blood pressure of 22/14 mm of Hg indicating the importance of yoganidra as an alternative or addition to drug therapy. Moreover, the Australian National B.P study has reported that only 30% of hypertensives in their sample were controlled by thiazide diuretics as first step care in hypertension management.

The drug studies used a stepped care package of multiple drugs to control blood pressure on those patients who failed to respond to a single anti-hypertensive drug. Brownstein and Dembert [18] in their study on mild hypertensives who had unsuccessful control with thiazides found significant reduction in diastolic blood pressure after yoga relaxation therapy. They also suggested yoga relaxation therapy could be an alternative treatment for mild hypertensives. Thus, yoga could provide supportive therapy to drug regimen, thereby help in reducing drug dosage and drug combinations. Hence in mild to moderate systemic hypertensive patients, yoga nidra in addition to drug treatment could be a supplementary therapy in reducing hypertension.

SUMMARY AND CONCLUSION

This matched case control study was aimed to determine the effect of yoga and meditation technique on essential hypertensives based on the changes produced in systemic blood pressure, heart rate, PEFR, BMI, and lipid profile. Data analysis was done by paired t test. The results showed significant decrease in Heart rate, systolic and diastolic B.P, in supine, sitting and standing positions. There was no significant change in lipid profile, PEFR and BMI. The results of this study can be summarized that the yoga technique can be used as adjunctive treatment with drug therapy on mild and moderate hypertensives. Yoganidra, a kind of meditation and muscle relaxation technique can be used to treat mild hypertensives before beginning of drug therapy. It can be practiced as one of lifestyle modification therapy in pre hypertensives and those with strong family history.

ACKNOWLEDGEMENT

I offer my servile thanks to the Almighty for His blessings conferred from above. A special word of thanks to Saveetha University to undergo a study in this institution, providing with the necessary facilities of the college for the study. It is my great privilege and honour to express my profound sense of gratitude to my professor Dr. Gowri Sethu, Professor and Head of the Department of Physiology, Saveetha University. I would like to thank Mr. Raja Ravi Shankar, founder, Universal World Peace Divine empire, (UWPDEM) kodambakkam, Chennai-24 for his invaluable guidance and generous help rendered during this study.

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FINANCIAL OR OTHER COMPETING INTERESTS:

None.

Date of Submission: **Nov 24, 2011**

Date of Peer Review: **Dec 13, 2011**

Date of Acceptance: **Jan 01, 2012**

Date of Publishing: **Feb 15, 2012**