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## Effect of yogic intervention on high blood pressure

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### Abstract

In this paper, the effects of yogic intervention on blood pressure in patients diagnosed with hypertension was investigated. The study was conducted among the participants from the age group of 30 to 55 years old. The participants were corporate employee, working in IT sector. 30 participants with high blood pressure, Systolic blood pressure of 120-179 and diastolic blood pressure less than 109 mm HG were chosen. The patients were requested not to change their medication during the study.

The intervention in this study was a daily 60 minute yoga class for 12 weeks. Each yoga class was subdivided into six sub-sessions followed by 12min Pranayama and last 20min meditation. The yoga class regularly began with slower warm-up exercises: Abdominal breathing, cooling breath, followed by yoga asanas, and meditation

Statistical significance of the change from baseline to end-program was evaluated with a one-sample t-test. Our results showed significant reduction of systolic BP (SBP) of up to 6 mmHg and a significant reduction of diastolic BP (DBP) of up to 5 mmHg compared to the baseline ( $p < 0.05$ ). The results imply that simple yoga exercises may be useful as a supplementary BP therapy in addition to medical treatment.

**Keywords:** BP: blood pressure, SBP: systolic blood pressure, DBP: diastolic blood pressure, HR: heart rate

### Introduction

Currently hypertension is one of the most common disease around the globe and its prevalence is rapidly increasing. Persistent hypertension results in premature death due to developing coronary heart disease, stroke and other cardiovascular diseases, such as heart failure [1]. According to Reddy *et al.*, [2] hypertension is fourth most common cause of premature death in developed countries and the seventh in developing countries. In India average 30% of adult hypertensive patients are from urban area and average 15% from rural area. Worldwide 15% of uncontrolled hypertensive patients are in India (Brown, 1994) [3]. High blood pressure is a medical condition in which the pressure of the blood pushing against the blood vessels (arteries) walls is persistently high. High blood pressure forces the heart to work harder to pump blood throughout the body. When blood pressure is high for prolonged periods, hardening of the arteries, heart failure, and other ailments can develop. Blood pressure is measured in millimeters of mercury (mm Hg) using two numbers, for example 120/80. The first number (the systolic blood pressure) represents the pressure in your blood vessels when your heart beats. The second number (the diastolic blood pressure) represents the pressure in your vessels when your heart rests between beats. Raised diastolic pressure is considered more serious than raised systolic pressure as it has more serious long-term effects. The health ministry program defines high blood pressure as a reading of more 140/90mmHg, whereas less than 120mm of Hg as Systolic blood pressure (SBP) and less than 80mm of Hg as Diastolic blood pressure (DBP) is considered as normal blood pressure. Medical treatment to cure hypertension is not always enough to control their blood pressure (BP) to target level of (140/90). Yoga the traditional practice from Indian culture has been used effectively in various health disorder issues [4-7] and can be used as a supplementary medicine. Pranayama or breath regulation has been greatly emphasized in Yoga and has drawn special attention from the scientific community. Uninostril and alternate nostril breathing has been of special significance in Yoga, since the nostrils are said to represent the subtle energy channels known as Nadis. Right nostril corresponds to Pingala Nadi, and the left to Ida, respectively. Breathing through a single specific nostril is said to affect the human system differently.

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Few studies were conducted to understand the immediate effect of yogic breathing techniques in hypertensive subjects. Sachdeva *et al.*,<sup>[8]</sup> investigated the effect of 12 weeks of yogic lifestyle on hypertension and Findings revealed a significant reduction in systolic and diastolic BP, body weight, serum cholesterol and triglyceride levels following the implementation of the yogic lifestyle. Bhavnani *et al.*,<sup>[9]</sup> in their study showed significant reduction in Heart rate (HR), SBP, pulse pressure, mean arterial pressure, rate-pressure product, with an insignificant fall in DBP in hypertensive patients following Sukha Pranayama for 5 min at 6 breaths per min. The practice of Pranava Pranayama demonstrated similar effects. Following 5 min of Pranava Pranayama, there was a reduction in SBP, HR and pulse pressure<sup>[10]</sup>. Another study showed immediate reduction in HR, SBP and pulse pressure in hypertensive patients following 27 rounds of left Uninostril breathing (UNB)<sup>[11]</sup>. A study showing the effect of 3 months' regular practice of slow breathing for 5 min/day maintaining 2:1 ratio of exhalation: inhalation demonstrated significant reduction in SBP, DBP, HR, Respiratory Rate and increased fingertip temperature<sup>[12]</sup>. Another study involving 6 weeks training in Pranayama along with antihypertensive medications reduced BP significantly compared to medication alone. Rate pressure product reduced significantly in the Pranayama group<sup>[13]</sup>.

Although several studies in the past have established that yoga addresses the issue of hypertension, but no empirical data co-relating the yoga way of living specifically reducing blood pressure for the IT employees, has been done till now. In this paper, the effects of yogic breathing on blood pressure among the patients working in IT sector diagnosed with hypertension was investigated.

### Methodology

The study is conducted among the participants from the age group of 30 to 55 years old. The participants were corporate employee, working in IT sector. 30 participants with high blood pressure, Systolic blood pressure of 120-179 mm Hg and Diastolic blood pressure less than 109 mm HG were chosen. The patients were requested not to change their medication during the study. The number of participants (minimum number of sample size) was determined according to calculation used by Pallavi *et al.*<sup>[4]</sup>. This experimental study estimated the sample size based on effect size = 0.45, power = 0.8, alpha level = 0.05, two-tailed, and it was calculated to be 28.

The intervention in this study was a daily 60- minute yoga class for 12 weeks. Each yoga class was subdivided into six 10-minute sub-sessions and 15min Pranayama and last 20min meditation. The yoga class regularly began with slower warm-up exercises: Abdominal breathing, cooling breath, and bellows breath, followed by forced abdominal breathing, meditation. The fidelity of the intervention was monitored and directed by a qualified yoga teacher. The detailed yoga module intervention is provided below.

### Yoga Module for Hypertension

1. Loosening Practices	Rounds	Time
Loosening of fingers	5	½min
Loosening of wrist	5	½min

Shoulder rotation	5	½min
Pada sanchalanasana, each	5	½min
Drill walking	5x10	1min

### 2. Instant relaxation technique (IRT) 2min.

### 3. Breathing practices

Hand in and out breathing	5	1min
Ankle stretch breathing	5	1min
Side bending, each	5	1min
Tiger breathing	5	1min
Straight leg breathing (alternate) leg	5	1min

### 4. Quick relaxation technique(QRT) 3min

### 5. Yoga Asanas

Vrikshasana		1min
Trikonasana		1min
Ardha paschimottanasana		1min
Ushtrasana		1min
Shashankasana		1min
Uttanapadasana (with single leg)		1min
Parvatasana		1min
Bhujangasana		1min

### 6. Deep relaxation technique 7min

### 7. Pranayam

Chandra anuloma viloma		4min
Nadi shuddhi		4min
Shitli		1min
Ujjai		1min
Bhramari		2min

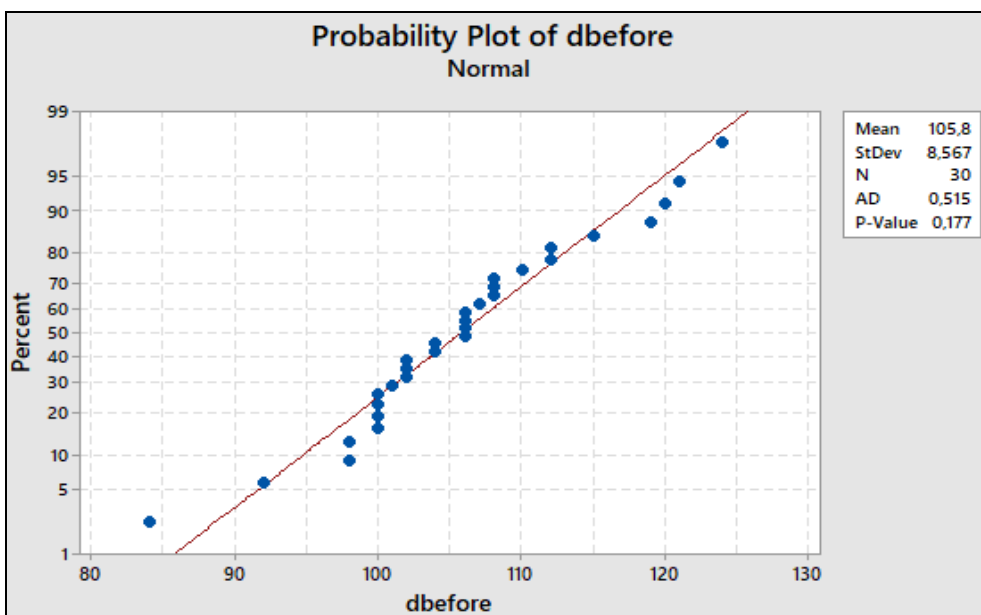
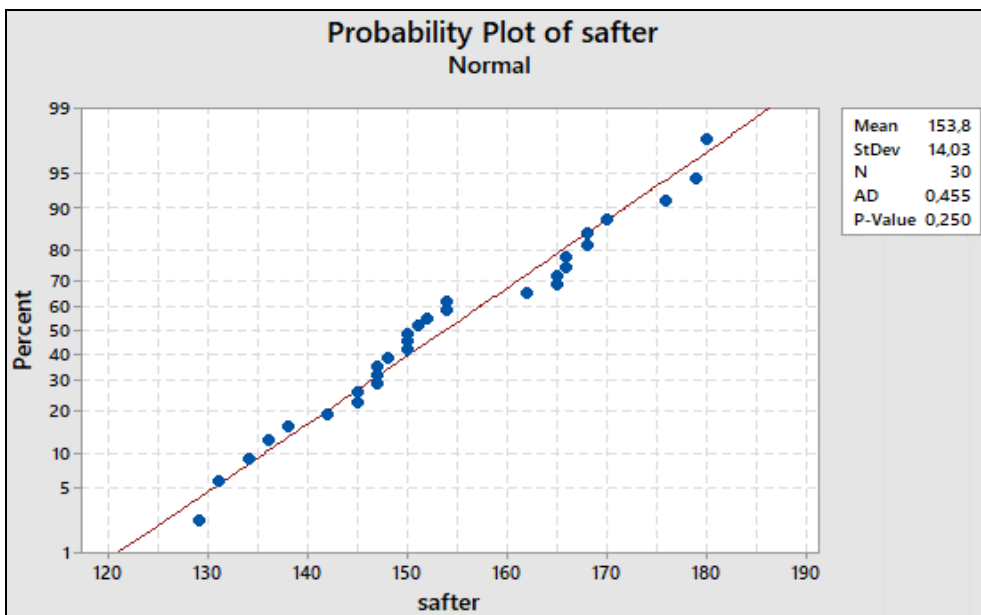
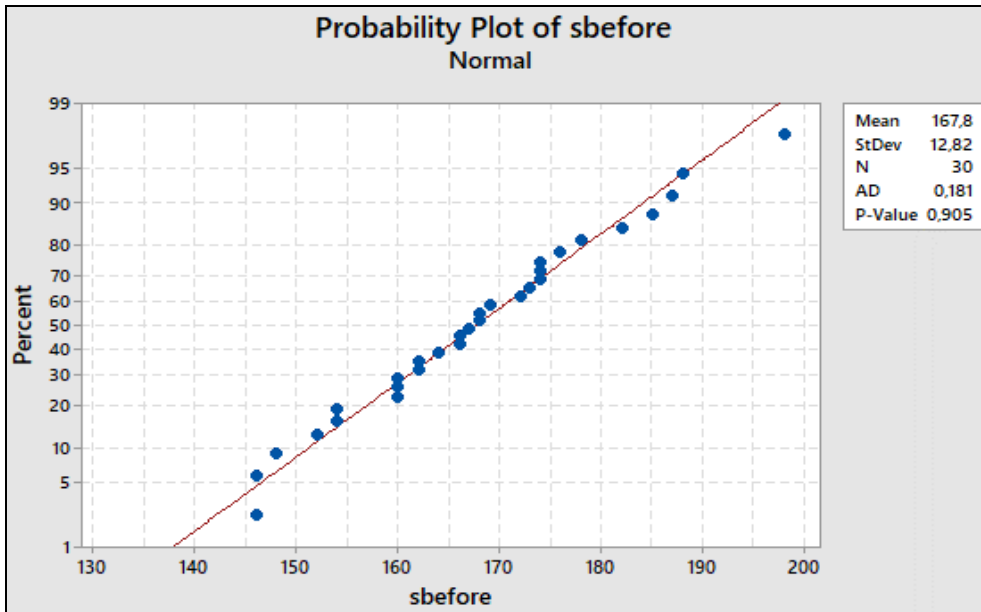
### 8. Meditation

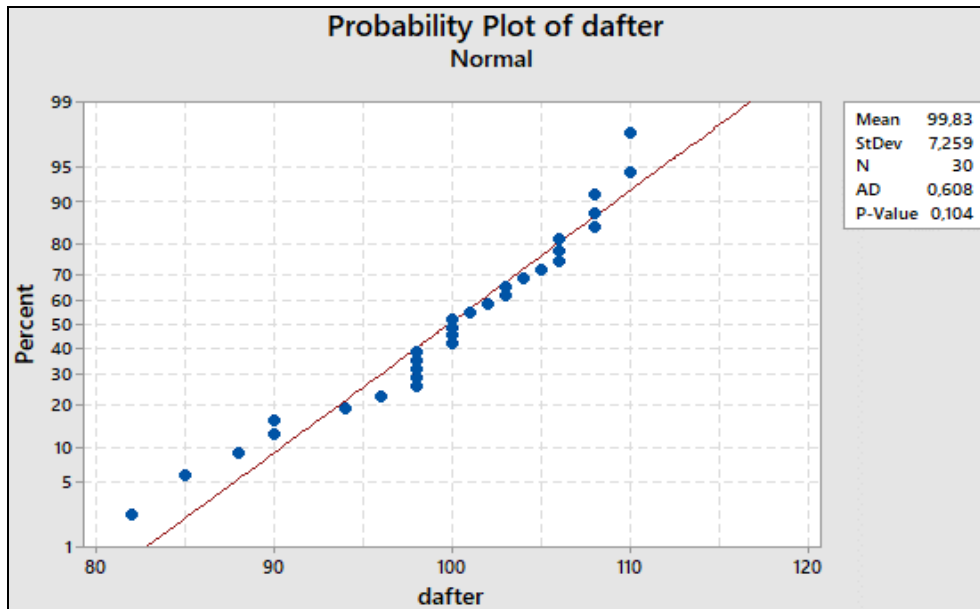
Nadanusandhan		10min
Om meditation		10min

Their Blood Pressure recorded at their first visit and then after 12 weeks of completing yogic intervention. The Blood Pressure measurements were recorded by using digital Blood Pressure apparatus with the subject seated. Data analyses were carried out by using Minitab version 18.0. Statistical significance of the change from baseline to end-program was evaluated with a two-sample t-test. P value <0.05 was considered as significant.

### Results & Discussion

Total number of participants included in this study were 30. These were no dropouts during the treatment period. To determine which Statistical test need to be done, first Anderson-Darlington (AD) test is done to check data distribution is Normal as most of the Statistical test are performed on normally distributed data. The SBP and DBP data before the yoga course (pre) and after completion of 12 weeks (post) are recorded. Figure 1 shows both pre and post SBP and DBP data are Normally distributed as p-values is higher than 0.05 and data are well fitted along the line of the probability plot.

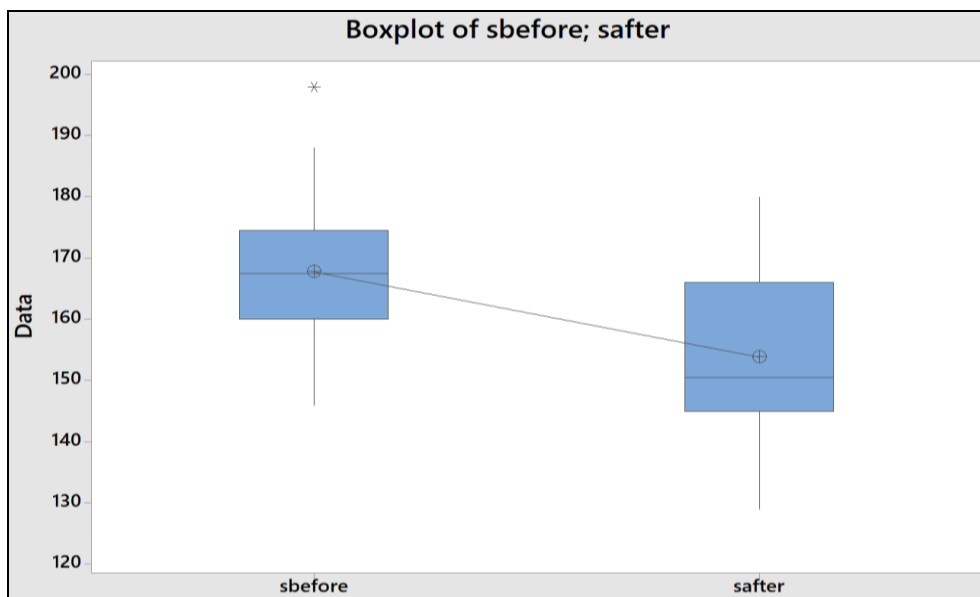




**Fig 1:** Probability Plot of (a) Pre Systolic Blood pressure (b) post systolic blood pressure (c) pre DBP and (d) post DBP shows Normal distribution

Figure 2. Shows the Minitab analysis of the box plot comparison of the mean value of the pre and post SBP. Mean value of the pre and post SBP are 167.8 and 153.8 mm Hg respectively. The t value and p-value from the 2-t test are 4.02 and 0.003. Since p value is less than 0.05 which confirmed

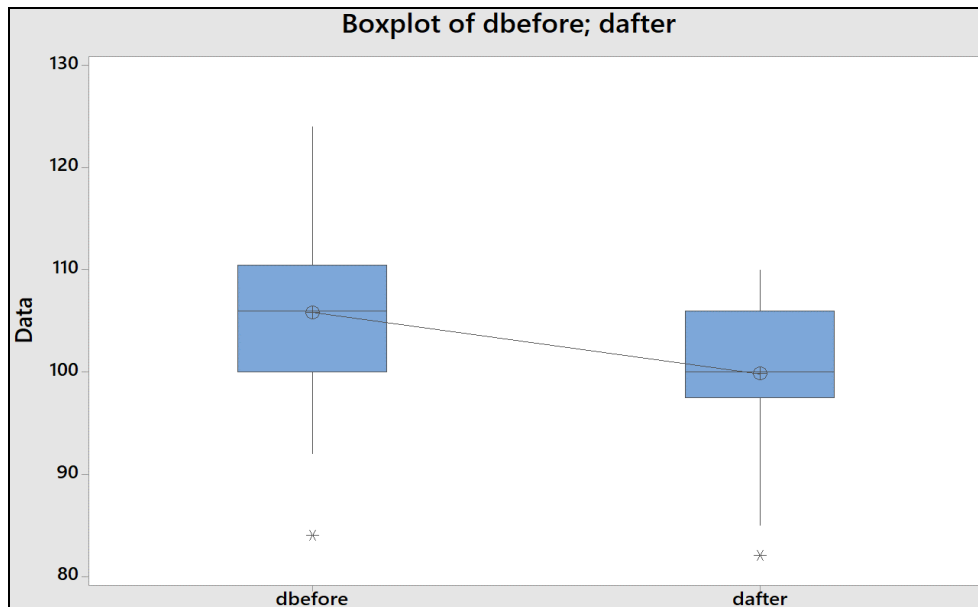
that there is a significant difference of pre and post SBP, indicating the participants demonstrated a significant reduction in their Systolic Blood pressure after the yoga intervention.



**Fig 2:** Box plot comparison of the mean value of the pre and post Systolic Blood Pressure

Similar analysis was done for DBP. Figure 3. Shows the box plot comparison of the mean value of the pre and post DBP. Mean value of the pre and post DBP are 105.8 and 99.8 mm Hg respectively. The t value and p-value from the 2-t test are 2.93 and 0.005. Since p value is less than 0.05 which

confirmed that there is a significant difference of pre and post DBP, indicating the participants demonstrated a significant reduction in their Diastolic Blood pressure after the yoga intervention.



**Fig 3:** Box plot comparison of the mean value of the pre and post Diastolic Blood Pressure

**Table 1:** Results are summarized

BP	Pre	Post	T-value	p-Value
SBP	167.8 +/-12.8	153.8 +/-14.0	4.02	0.003
DBP	105.8 +/-8.6	99.8 +/-7.3	2.93	0.005

Our results showed significant reduction in SBP (14mmHg) and DBP (6mmHg) for the participants who completed 12 weeks' yogic intervention. These results are in agreement with the previous studies where significant reduction of systolic BP (SBP) of up to 6 mmHg and a significant reduction of diastolic BP (DBP) of up to 5 mmHg compared to baseline [5-9].

The asanas included in our yogic intervention belong to the forward bends, supine, sitting and some of the inversion group. However forward bends are the fundamental asanas to be practiced to reduce high blood pressure, as the sense organs, eyes, nose, throat, and tongue are relaxed thereby resting the sympathetic nervous system and creating a positive effect on parasympathetic system. Yogic breathing includes modulation of the pace of breathing, viz. slowing down or pacing the breath, manipulation of nostrils, chanting of humming sounds, retention of breath etc. Yoga promotes the flexibility of the arteries, reduces the rigidity of the arteries and also promotes the free flow of blood in the arteries thus resulting in control of hypertension.

Meditation is the study of concentration. The mind and body are very intimately connected, when the mind is completely at ease, the whole body gains complete rest. Practicing meditation techniques in times of physical or mental stress helps to manage the 'fight of flight' response to negative stress and lower blood pressure.

### Conclusion

Our results showed a significant reduction in SBP (14mm Hg) and DBP (6mm Hg) among the participants who completed 12 weeks' yogic intervention. Yoga promotes the flexibility of the arteries, reduces the rigidity of the arteries and promotes the free flow of blood in the arteries thus resulting in control of hypertension and help to reduce the SBP and DBP. Yoga can reduce stress-induced hypertension, while addressing its underlying causes. It pacifies the sympathetic nervous system and slows down the heart, while teaching the muscles and mind to relax deeply.

It may be concluded that yogic practices have a highly positive impact in the reduction of BP and can be used as supplementary medical techniques. Overall, we found the practice of yogic breathing safe, when practiced under guidance of a trained teacher, and have no side effects.

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