

# Effects of Yoga on Blood Pressure and Malondialdehyde (MDA) in Mild Hypertensive Patients

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## Abstract

**Background:** Cardiovascular diseases (CVD) is considered a prominent cause of mortality. Essential hypertension is regarded as the most important risk factor for CVD in modern society despite advanced and effective management. Malondialdehyde (MDA), an indicator of oxidative stress, is produced by the oxidation of polyunsaturated fatty acid. Nadishodhan pranayam leads to decrease stress as well as blood pressure. **Subjects and Methods:** It was an interventional type of study done between January 2020 to May 2020. Ninety-seven mild hypertensive patients (53 males and 44 females) of group I completed the yoga program. While fifty normotensive subjects were included as a control in group II. Blood pressure and MDA were measured of every participant before and after three months of the yoga program. **Results :** Total ninety-seven mild hypertensive patients of age  $33.6 \pm 8.66$  years of group I completed three months yoga program. However, fifty subjects ( $34.7 \pm 7.73$  years) of group II had not done any yogic exercise for three months. This study showed a significant difference in SBP ( $p < 0.001$ ), DBP ( $p < 0.001$ ), HR ( $p < 0.001$ ), PP ( $p < 0.001$ ) and MAP ( $p < 0.001$ ) group I mild hypertensive patients after following three months yoga program. There was a significant difference between before and after the yoga program MDA level of group I mild hypertensive patients. However, there was an insignificant difference between before and after three months level of MDA in group II control subjects. **Conclusion:** In this study, it has been observed that the daily practice of yoga improves the blood pressure of mildly hypertensive patients. Moreover, it substantially decreases oxidative stress. Yoga can be an effective alternative to reduce blood pressure in mild hypertensive patients either with medication or without medication.

**Keywords:** Yoga, hypertension, MDA, CVD.

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## Introduction

Cardiovascular diseases (CVD) are considered one of the most prominent causes of mortality in the world.<sup>[1]</sup> Essential hypertension is a significant risk factor for CVD in modern society despite advanced and effective management.<sup>[2]</sup> Disturbance of endothelium functioning leads to loss of dilating ability of endothelium results in increased blood pressure.<sup>[3]</sup> Hypertension is a multi-factorial disorder including various aetiological factors like obesity, high lipids diet, smoking, stress, sedentary lifestyle, excessive alcohol and high sodium diet, etc.<sup>[4-6]</sup> Disequilibrium between oxidants and antioxidants status in the body leads to a well-known condition known as Oxidative stress. This plays a pivotal role in the growth of a variety of pathological conditions, including hypertension.<sup>[7,8]</sup> Malondialdehyde (MDA), a key indicator of oxidative stress, is produced by oxidation of polyunsaturated fatty acid. Moreover, MDA is considered one of the important markers for coro-

nary artery disease. Increased reactive oxygen species play an essential role in the pathogenesis of hypertension.<sup>[8-10]</sup>

Daily practice of Yoga causes a decrease in mental stress and an increase in memory. Yoga has been found effective in improving weight, BMI, dyslipidemia, hypertension and heart rate.<sup>[11-15]</sup> Psychological stress has been associated with a high level of oxidative stress; however, relaxation of stress causes decreased oxidative stress.<sup>[8]</sup> Nadishodhan pranayam leads to reduce stress as well as blood pressure.<sup>[16,17]</sup> Therefore, this study was conducted to examine the effect of yoga on blood pressure and MDA of mildly hypertensive patients.<sup>[18,19]</sup>

## Subjects and Methods

### Type of study

The present can be classified as an interventional type done between January 2020 to May 2020.

## Study Population

The study population was divided into two groups. Group I consisted of one hundred nine mild hypertensive patients (60 males and 49 females), between 20 and 40 years of age while group II included 50 normotensive subjects of the same age and sex-matched. All the patients were recruited from Ukraine Medical University. However, twelve mild hypertensive patients (7 males and 5 females) left the study in between due to various reasons and ninety-seven mild hypertensive patients (53 males and 44 females) completed the yoga program. Inclusion criteria for the study were blood pressure from  $>140/90$  mm Hg to  $<160/110$  mm of Hg, 18 body mass index  $18.5\text{--}25$  kg/m<sup>2</sup>. Exclusion criteria were hypertensive patients on any type of antihypertensive medicines or suffering from any type of chronic disease, any type of disability. The present study obtained ethical approval from the Institutional ethical committee. Informed consent was obtained from study participants.

## Yogic intervention

Group, I mild hypertensive patients were asked to perform yogic exercise “Nadi Shodhan Pranayama”.<sup>[16,17]</sup> (forced one side nostril breathing) early in the morning for 30 minutes, 6 days a week.

## Blood pressure

Participants’ blood pressure was measured twice- once before the intervention and then three months after the intervention. The auscultatory method was used at every 10 min interval by Sphygmomanometer.

## Sample collection

The collection of fasting samples was carried out early morning once before and once after the intervention.

## Biochemical Parameters

Thiobarbituric acid method (TBA) was employed to measure serum MDA. We used “TBARS assay kit” by Cayman chemical company Ann Arbor, USA and “Biochemistry Analyser E-C5VZ(10k)” by Transasia (India) for the biochemistry analysis.

## Statistical Analysis

All the statistical analysis was performed on IBM SPSS 21. Unpaired t-test was conducted with a p-value of less than 0.05, indicating statistical significance. Results are presented in mean and standard deviation.

## Results

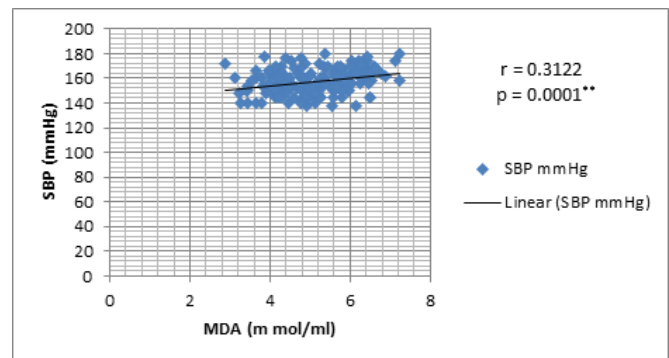
Total ninety-seven mild hypertensive patients of age  $33.6 \pm 8.66$  years of group I completed three months yoga program. However, fifty subjects ( $34.7 \pm 7.73$  years) of group II had not done any yogic exercise for three months. The present

study notes a significant difference in SBP ( $p < 0.001$ ), DBP ( $p < 0.001$ ), HR ( $p < 0.001$ ), PP ( $p < 0.001$ ) and MAP ( $p < 0.001$ ) group I mild hypertensive patients after the yoga intervention. [Table 1]

[Table 2] shows an insignificant change in SBP ( $p > 0.05$ ), DBP ( $p > 0.05$ ), HR ( $p > 0.05$ ), PP ( $p > 0.05$ ) and MAP ( $p > 0.05$ ) of group II after three months.

[Table 3] reveals a significant difference between before and after the yoga program MDA level of group I mild hypertensive patients. However, there was an insignificant difference between before and after three months level of MDA in group II control subjects.

[Figure 1a] presents the correlation coefficient for MDA and SBP in mild hypertensive patients of group I. It shows a positive correlation between MDA and SBP.



**Figure 1: Correlation between MDA & SBP. MDA =Melanodialdehyde, SBP = Systolic blood pressure, \*\* p = <0.01 (comparing pre and post value).**

[Figure 1b] presents the correlation coefficient for MDA and DBP in hypertensive elderly patients in group II. The figure shows a positive correlation between MDA and DBP.

## Discussion

Finding from this study suggest that the yoga program for three months have substantially decreased blood pressure in mild hypertensive patients. The current study is consistent with the results of a study conducted by Svetkey et al.<sup>[20]</sup> Similarly, Jiro et al.<sup>[21]</sup> recorded that regular exercise significantly reduces systolic and diastolic blood pressure in mild hypertensive patients. Likewise, Pal GK et al recorded a significant decrease in blood pressure after following a yoga program.<sup>[22]</sup> This decrease in blood pressure seems to be due to yoga improving the autonomic nervous system’s balance via decreasing sympathetic activity and increasing the parasympathetic nervous system.<sup>[22,23]</sup>

**Table 1: Evaluation of pre-yoga and post-yoga values of blood pressure in group I mild hypertensive patients.**

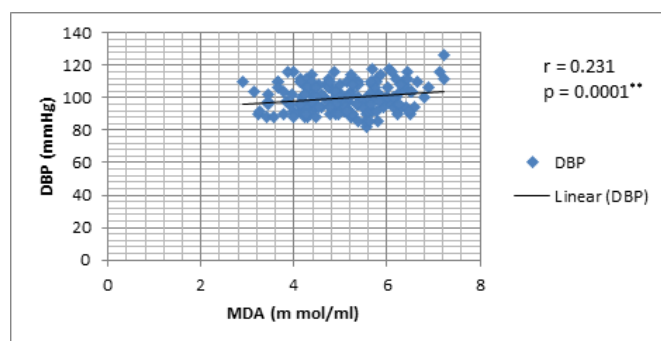
Parameters	Before Yoga	After Yoga	P-value
Systolic blood pressure mmHg	148.08 ± 10.04	142.17 ± 12.46	<0.0001
Diastolic blood pressure mmHg	104.15 ± 7.82	98.27 ± 6.78	<0.0001
HR	76.13 ± 6.58	72.26 ± 5.29	<0.0001
PP	56.17 ± 6.43	53.19 ± 6.67	<0.0001
MAP	126.3 ± 8.72	119.42 ± 8.35	<0.0001

**Table 2: Evaluation of pre-yoga and post-yoga level of blood pressure group II control subjects.**

Parameters	Before Yoga	After Yoga	P-value
Systolic blood pressure mmHg	126.28 ± 9.04	127.17 ± 12.46	NS
Diastolic blood pressure mmHg	87.25 ± 8.32	88.17 ± 7.58	NS
HR	72.44 ± 5.6	72.26 ± 6.19	NS
PP	48.17 ± 4.27	49.35 ± 4.69	NS
MAP	112.8 ± 6.66	112.89 ± 7.22	NS

**Table 3: Evaluation of pre-yoga and post-yoga levels of MDA in both group I mild hypertensive patients and group II control subjects.**

Parameters	Group I		Group II	
	Pre yoga values	Post yoga values	Pre yoga values	Post yoga values
MDA (mmol/ml)	5.16 ± 0.78	4.26 ± 0.56	2.86 ± 0.54	2.96 ± 0.67
P value	<0.0001		NS	



**Figure 2: Correlation between MDA & DBP. MDA = Melanodialdehyde, DBP = Diastolic blood pressure, \*\* p = <0.01 (comparing pre and post values).**

Further, the present study showed a significant decrease in heart rate, pulse pressure, and mean arterial pressure which is consistent with Pal GK et al. [22] The reduction in HR, PP and MAP are due to yoga as it affects the baroreflex sensitivity which in turn reduces heart rate and blood pressure. [24]

It has been suggested in the literature that uncontrolled reactive oxygen species have been found to be involved

in the production and progression of various pathological conditions like CVD. [25,26] Moreover, increased oxidative stress has been reported in the early stage of hypertension; though, the development of hypertension is caused by various factors. However, the role of ROS cannot be picked out. [27-29] MDA has been found elevated in hypertensive patients due to increased level of ROS which results in increased lipid peroxidation. [26] Furthermore, the current study observed a significant decrease in MDA in mildly hypertensive subjects. The results are consistent with previous studies of Gordon et al. [30] Patil et al. [31] and Singh et al. [32] where they recorded a significant decrease in blood pressure after the following yoga for different periods of time. This decrease MDA level seems to be the due decrease of ROS as regular yoga practice induces the production of antioxidants like glutathione and superoxide dismutase, decreasing the lipid peroxidation. [32] This decrease of MDA in mild hypertensive patients may reduce the likelihood of CVD in hypertensive patients as MDA is a crucial risk for CVD. [8]

## Conclusion

This study observes that the routine practice of yoga improves the blood pressure of mildly hypertensive patients. Moreover,

it substantially decreases oxidative stress. Yoga can also be a useful alternative for reducing the blood pressure in mild hypertensive patients either with medication or without medication. We emphasize more researches on a larger population should be done to make an effective module of the yoga program to control blood pressure.

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