PILOT STUDY

A Single Mindfulness-Based Meditation Session Can Produce Reductions in Cardiovascular Risk in Hypertensive Patients: A Pilot Study

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ABSTRACT

Background • Several non-drug treatment approaches for systemic arterial hypertension have been studied aimed at reducing the adverse effects of this clinical condition. In addition to exercise training, which already has many of its modalities consolidated in the scientific field, body and mind practices have gained strength and deserve attention in the science and treatment of hypertension. The literature shows that meditation practices have numerous health benefits, one of which is blood pressure (BP) control.

Objective • This study aimed to evaluate the acute effects of a single mindfulness-based meditation on BP in adults with hypertension.

Methods • Research was developed that evaluated the BP of 5 adult women with controlled hypertension. As a data collection instrument, we used 2 sessions of ambulatory BP monitoring (ABPM): the first was a control session and the second a meditation session. Systolic (SBP), diastolic (DBP) and mean blood pressure (MBP) were evaluated at the pre- and post-session in addition to heart rate (HR), with clinical and ambulatorial measurements, during the day, night, morning surge and a 24-hour period. Data analysis was performed using one-way analysis of variance (ANOVA) for the ABPM data and two-way ANOVA to analyze blood pressure.

Results • The main results found were a statistically significant reduction in SBP in the morning and a tendency toward a significant decrease in MBP during the same period ($P = .057$). There were no significant changes in the other variables analyzed.

Conclusion • Therefore, we concluded that a single meditation session was effective only in reducing morning SBP. (*Altern Ther Health Med.* 2022;28(2):18-23).

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BACKGROUND

Cardiovascular disease (CVD) has an enormous impact on world health, generating elevated public health costs. In addition, this cluster of diseases is the primary cause of death worldwide.[1] The contemporary lifestyle, characterized by poor quality food intake, sedentary behavior and poor stress control, has been identified as one of the main factors responsible for the increase in the prevalence of CVD.1 Within this cluster of diseases, we highlight systemic arterial hypertension (SAH) as this condition is the major cause of several other CVDs.[1]

Published data suggests that the non-pharmacologic treatment of SAH should be implemented as soon as possible. This kind of therapy can produce clinical improvements in blood pressure (BP) ranging from 3 to 11 mmHg.[1,2] This data is of paramount importance since Whelton, et al have shown that even small reductions in BP due to non-pharmacologic treatment can cause decreases in CVD and total mortality.[3] Thus, the engagement of a multi-professional team is a cornerstone in order to promote better disease control and reduce risk factors.[1]

Among the main non-pharmacologic treatments, we highlight complementary and integrative practices (CIP). In fact, studies of CIP and BMP have shown promising results in improving health-related quality of life (QoL), including BP control.[4] These practices represent a novel model of health-related activities with a patient-centered focus that are well accepted. Within this group of practices, we highlight Pilates, yoga, and meditation. Some studies applying these

modalities in patients with hypertension have shown promising results in improvement in BP and QoL.[5-8]

To date, there is no consensus regarding the definition of meditation;[8,9] however, meditation can be categorized as 5 different practices: mindfulness, Tai Chi, mantra meditation, yoga and finally Qi Gong.[8] In this study, we focused on mindfulness, defined here as "the awareness that emerges through paying attention, on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment by moment."[10] Several studies have shown that mindfulness can increase awareness of thought related to the present moment in individuals, enabling them to cope with emotional stress and aiming to tackle the maladaptive behavior related to stressful situations.[11,12] In an extensive 2015 literature review,[13] Louks, et al suggested that mindfulness interventions can have cardiovascular (CV) effects mediated by 3 components: (1) attention control, (2) regulation of emotion and (3) self-awareness. These effects are all related to the impact of long-term training in mindfulness, with improved health due to self-regulation processes and physiologic and behavioral effects that modulate the response to stress and enable change in attitudes.

Mindfulness-based programs were developed for specific populations, targeting specific clinical conditions. Until 2019, no mindfulness-based program had been customized to patients with elevated BP. In an adaptation of the standardized Mindfulness-Based Stress Reduction (MBSR) program developed by Jon Kabat-Zin, Louks and colleagues (2019)[14] developed Mindfulness-Based Blood Pressure Reduction (MB-BP), a protocol lasting 8 weeks with 27.5 hours of guided practice in addition to 45 minutes of daily practice, including a range of mindful skills, such as body scan exercises, breathing practices, meditation and yoga. In their single-arm clinical trial, several alterable determinants of BP were improved at 1-year follow-up and perceived stress was lowered. The study suggests that the impact of MB-BP on BP is more evident in patients with stage 2 hypertension, with a more significant effect in the first 3 months. However, the study's lack of a control group fails to provide explanations of how the different techniques and skills can affect BP. According to Ditto, et al (2006),[15] "little is known about the immediate physiological effects of different components of the [MBSR] program." We do not know, for example, the acute effects of a single body scan meditation session on the BP of individuals with hypertension.

Data published in recent reviews and meta-analyses shows an improvement in health conditions, like BP control, insulin resistance and cellular ageing reductions with this kind of practice.[8,16] Some mechanisms hypothesized to produce this non-pharmacologic effect of meditation on BP control are increases in nitric oxide levels, reduction in β-adrenergic sensibility and in aldosterone level, leading to reduced peripheral vascular resistance, and also promoting better balance in the autonomic nervous system by decreasing sympathetic nervous tone.[8,16]

Despite this promising data, there are few publications about the effects of meditation in patients with hypertension.

Therefore, in this study we adapted the MBSR protocol; the actual protocol takes 8 weeks and we tested only an acute session of MBSR. Notwithstanding, it is important to note that most of the studies published regarding MBSR or other types of meditation were conducted as chronic meditation.

We hypothesized that a single MBSR session can reduce BP in patients with hypertension. For that purpose, the aim of this study was to evaluate the ambulatory BP of patients with hypertension after a single MBSR session.

METHODS

The study was approved by the ethics committee of the Federal University of São Paulo (UNIFESP – CEP – 3.202.485) and all participants signed a consent form agreeing with all procedures. The study protocol was approved by the Clinical Trials Registry ReBec (Registros Brasileiros de Ensaios Clínicos) under the register number RBR-6jmwc8 and followed the standards set out in the Declaration of Helsinki.[17] The trial design is parallel.

Participants

The recruitment process looked for participants of both sexes, but only women signed up for the study. The sample was composed of 5 women with hypertension (age 45.8 ± 4.15 years). All patients completed 2 randomized visits: one to an MBSR session (MS) and one to a control session (CS).

The inclusion criteria were patients who: (a) had controlled hypertension, (b) had a sedentary lifestyle for at least 6 months at the beginning of the study, (c) were age 30 to 50 years and (d) had no experience with meditation. Exclusion criteria included (a) patients with a diagnosis of any disease that prevents mediation practice, or any disease that can influence BP, and (b) not attending one of the visits.

To characterize the sample regarding physical activity level, the short form of the International Physical Activity Questionnaire (IPAQ-6) was used. Height was collected using standard height measurement equipment (Sanny ES2020, American Medical do Brasil, São Bernardo do Campo), and weight was collected using a digital scale (Tanita BF680®, Tanita Corporation of America, Chicago, USA).

Sessions

Both sessions (MS and CS) were conducted in the same room at a temperature between 21°C and 24.5°C and lasted for 30 minutes. All windows were kept closed to avoid any external interference. All sessions were conducted at the Federal University of Sao Paulo, Brazil in a random order defined by draw conducted by the principal investigator.

Meditation Session

The MS session consisted of: brief explanation of meditation and good body position (5 minutes); body scanning: using the body scan medication technique (15 minutes); breathing technique (5 minutes); brief conversation about the experience (5 minutes).

Control Session

The CS session consisted of: a brief talk about the study protocol (5 minutes); supine position: the participants lay in the supine position without any instruction (15 minutes); most comfortable body position: the participants assumed the most comfortable body position (5 minutes); brief conversation about the experience (5 minutes).

Ambulatory Blood Pressure Monitoring

The ambulatory blood pressure monitoring device (ABPM) (Dyna-MAPA, Cardios®; São Paulo, SP, Brazil) was used to measure clinical BP before and after each visit and to analyze the 24-hour period following the sessions. The participants were asked to record their hours of sleep, time of awakening, and medication regimen. The ABPM recorded BP every 15 minutes during the daytime and every 30 minutes during the nighttime. Systolic (SBP), diastolic (DBP) and mean (MBP) blood pressure, as well as heart rate (HR), were assessed during 4 periods: 24 hours, daytime, nighttime and morning surge according to the sleeping hours recorded in the participants' diaries. The morning rise period was calculated as mean BP during the 2 hours before the participants reported awakening.

Statistical Analysis

All statistical analysis was performed using IBM SPSS Statistics 23 (Armonk, NY, USA). Results are shown as mean ± standard deviation (SD). All data presented normal distribution according to the Shapiro-Wilk test. For analysis of BP and HR, the two-way within-subjects ANOVA (see Table 2) was used. The analysis of variance (one-way within-subjects ANOVA) was performed to evaluate the differences between the ABPM data (see Table 3). The *P* value was set as 5% ($P < .05$).

RESULTS

To characterize the sample, anthropometric data (age, height, weight, BMI) and medications taken was collected and the International Physical Activity Questionnaire (IPAQ) was administered (see Table 1).

Mean SBP, DBP and MBP values were compared before, after and between sessions (see Table 2). No statistically significant differences between sessions or effects caused by the sessions were observed in any of the hemodynamic analyzed variables.

Table 1. Sample characteristics

Age (years)	45.8 ± 4.15
Height (cm)	155.7 ± 6.56
Weight (Kg)	74.6 ± 12.69
BMI (Kg/m²)	30.8 ± 4.40
IPAQ Level	
Low	20%
Moderate	80%

Abbreviations: BMI, Body mass index; IPAQ, International physical activity questionnaire.

Table 2. Clinical Blood Pressure Measures

	Control Session		Meditation Session		
	Pre	**Post**	**Pre**	**Post**	***P* Value**
SBP (mmHg)	131.8 ± 12.62	130.0 ± 17.38	127.2 ± 16.18	133.6 ± 18.77	.533
DBP (mmHg)	85.0 ± 8.03	85.2 ± 7.66	83.0 ± 10.30	82.0 ± 11.47	.671
MBP (mmHg)	105.2 ± 9.83	105.6 ± 11.26	102.0 ± 11.07	105.6 ± 14.60	.693
HR (bpm)	71.7 ± 13.15	69.6 ± 10.55	74.5 ± 16.70	68.6 ± 9.79	.644

Abbreviations: SBP, Systolic blood pressure; DBP, Diastolic blood pressure; MBP, Mean blood pressure; HR, Heart rate; mmHg, Milimeters of mercury; bpm, Beats per minute.

Table 3. Ambulatory Blood Pressure Monitoring

24h			
	Control Session	**Meditation Session**	***P* Value**
SBP (mmHg)	120.2 ± 12.32	119.8 ± 13.88	.794
DBP (mmHg)	75.2 ± 6.30	72.6 ± 8. 50	.320
MBP (mmHg)	95.8 ± 8.50	94.2 ± 10.57	.412
HR (bpm)	71.8 ± 9.60	69.8 ± 7.89	.258
Daytime			
SBP (mmHg)	123.0 ± 12.35	123.2 ±13.59	.925
DBP (mmHg)	77.8 ± 6.72	75.8 ± 7.98	.483
MBP (mmHg)	98.4 ± 8.85	97.4 ± 10.21	.662
HR (bpm)	73.0 ± 9.82	71.6 ± 7.47	.475
Nighttime			
SBP (mmHg)	109.0 ± 9.69	108.0 ± 12.77	.788
DBP (mmHg)	65.0 ± 2.00	62.2 ± 7.46	.368
MBP (mmHg)	85.4 ± 5.46	83.6 ± 9.48	.562
HR (bpm)	66.2 ± 8.32	63.8 ± 8.29	.261
Morning Surge			
SBP (mmHg)	110.4 ± 6.84	106.8 ± 8.38[a]	.025
DBP (mmHg)	66.8 ± 5.85	62.0 ± 8.34	.147
MBP (mmHg)	86.8 ± 4.55	82.4 ± 6.99	.057
HR (bpm)	65.6 ± 6.19	61.8 ± 6.57	.156

[a]$P < .05$ Pre vs Post.

Abbreviations: SBP, Systolic blood pressure; DBP, Diastolic blood pressure; MBP, Mean blood pressure; HR, Heart rate; mmHg, Milimeters of mercury; bpm, Beats per minute.

When the AMBP values sessions were compared, only SBP during the morning surge was statistically lower after the meditation session t(4) = -3.497, $P < .05$ (see Table 3). In addition, MBP values compared between sessions showed a trend toward significance after the meditation, t(4) = -2.648, $P < .05$ (see Table 3).

DISCUSSION

The main result from our present study was the effect of meditation sessions on the reduction of SBP during the morning surge in patients with hypertension. In addition, there was a trend toward to a reduction in MBP after meditation sessions during the same period compared with the control session. However, there was no difference in the other hemodynamic variables when compared either before or after each session.

Nonetheless, such reductions in the morning surge are really important as this period of the day is characterized as presenting the highest risk for a CV event.[18,19] In spite of the increase in BP and HR during the morning period due to the normal circadian, behavioral and autonomic cycles,[19] several other events raise the risk for CV events, such as increased platelet adhesiveness and risk for arrhythmia, further increasing the risk for CV events.[20]

The BP morning surge is closely linked to CV risk, end organ damage and cerebrovascular events.[18] In addition, some data point to a prognostic value of the morning surge as an indicator of plaque instability, stroke, vascular inflammation, left ventricular hypertrophy and all-cause mortality. However this data is still inconclusive.[18,21] Thus, our result is of paramount importance, although a longitudinal study aiming to analyze morning surge data and morbimortality is needed in order to confirm the beneficial effects of meditation.

There is a lack of data regarding the acute effects of a single meditation session. This makes it difficult to compare the results of our study with other studies, since the majority of studies of meditation were conducted with a minimum duration of 2 months. The patients were followed for less than 2 months in only 3 studies.[22-24]

In those 3 studies, the protocol was not similar regarding the meditation technique, sample, or follow-up time. A study published by Kaushik, et al (2006) compared hemodynamic responses during mental relaxation and slow breath in patients with hypertension. The sample was composed of 100 patients of both genders, age between 28 and 72 years. In addition, not all the patients were receiving anti-hypertensive treatment. The sessions consisted of 10 minutes of mental relaxation, 15 minutes of silence and 10 minutes of slow breath. The results showed reductions in SBP and DBP after application of both techniques.[23]

Kretzer, et al (2007) applied the Ho'oponopono technique—a combination of breathing exercises, prayers and meditation—in 23 patients >age 30 years with a diagnosis of pre-hypertension or hypertension, and surprisingly the session lasted 4 hours. The results showed a clinically relevant reduction in SBP and DBP.[24]

A study conducted in normotensive individuals applied the mindfulness technique and found a decrease in SBP. A total of 60 normotensive students of both genders age 18 to 22 years were separated into meditation and control groups. The meditation group performed 30 minutes of mindfulness meditation on 7 consecutive days. In addition to the BP reduction, the meditation group showed a decrease in anxiety on a self-rating scale. Therefore, we hypothesized that this reduction in anxiety could have a role in the BP decrease experienced by the meditation group.[22]

In order to analyze the short-term autonomic and CV effects of meditation, Ditto, et al (2006)[15] found significantly reduced (gender × session interaction) diastolic BP in women when they practiced body scan meditation compared with other relaxing activities, like listening to an audiobook. In the study, 30 healthy young adults (both genders, mean age 19.2 years ± 2.1 years) were separated into 2 groups that practiced either 20 minutes of body scan meditation or listened to an audiotape (the first 20 minutes of a commercially available tape of a JK Rowling novel) in counterbalanced order. They suggest that this technique may be beneficial in terms of progressive muscle relaxation in patients with cardiac disease and/or hypertension, who generally exhibit reduced cardiac vagal activity.

A recent systematic review included 5 published studies that analyzed the effect of MBSR on BP in patients with hypertension.[25] All analyzed studies were published between 2012 and 2017; the protocol had to be MBSR. Studies with short protocols or that were non-MBSR were excluded from the analysis. This was the first published review regarding the MBSR and BP response in patients with hypertension, and it confirmed the lack of data regarding MBSR and CV risk. In addition, the results showed significant reductions in SBP and DBP after periods of MBSR.[25]

Several other types of meditation have been studied and linked to BP reduction. The transcendental meditation program, a stress reduction technique, has been highlighted as efficient in reducing BP in adults and adolescents.[26,27] Clinically relevant reductions in SBP and DBP—4 mmHg and 2 mmHg, respectively—were observed in a systematic review and meta-analysis regarding transcendental meditation and stress control.[27] The possible mechanism involved could be the reduction in stress reactivity and sympathetic tonus.[26]

Several studies have investigated the effects of other BMP such as yoga and Pilates on BP, increasing the knowledge regarding the non-pharmacologic treatment of subarachnoid hemorrhage (SAH). Data regarding Pilates and BP responses are scarce, although the results from a recent published review are promising for its use as a tool for non-pharmacologic treatment of SAH.[6] Rocha, et al (2019) showed that even 1 Pilates session can produce reductions in BP; however, those reductions were only seen in the first 60 minutes after the Pilates session.[28] The mechanisms involved in such reductions are not clear. However, a feasible hypothesis is that, as in Pilates, meditation is based on movements, body

positions and breathing control, and improvements in autonomic balance may result in and promote better BP control in individuals who engage in these practices.

A large study of patients with hypertension who underwent a short home-based yoga intervention showed a reduction in SBP and DBP. However, the reductions were seen in both the intervention and control groups, and the magnitude of reductions was similar in both groups.[29] Cramer, et al (2018) examined BP response after 12 weeks of yoga. The researchers assigned the participants to one of three groups: one involving yoga postures, the second group only involving meditation and breathing techniques and a control group. The results corroborate our results: reductions in SBP were found in both the yoga posture group and the yoga meditation group.[30]

This data shed light on the CIP as a powerful tool as an adjuvant to SAH treatment, once this pool of data showed clinically relevant reductions in BP due to these alternative techniques. It is noteworthy that these practices promote reductions in BP similar to those promoted by classic non-pharmacologic SAH treatment. However, more studies are needed to confirm and discuss these positive results and clarify the mechanisms involved.

In spite of the positive results, there are several limitations and methodologic errors in the published studies.[31] Among the limitations found are divergent methods in BP evaluation, study sample size, participant demographics, high dropout rate and dissimilar protocols.[31]

Study Limitations

In a similar fashion, our study has some limitations, the main one being the small sample size. In addition, the fact that 80% of the participants were classified as active on the IPAQ could have a major influence on the result, as it is clear that people who engage in physical activities are more prone to better BP control.[3,32] But it is important to highlight that none of the participants were engaged in a formal exercise program. Furthermore, all participants in our study had their BP under control, which can limit the power of meditation to reduce BP. This hypothesis is supported by the fact that the magnitude of the BP reduction after an acute period of exercise has an inverse correlation with the BP before the exercise session.[33]

CONCLUSION

Our study results showed SBP reduction in the morning surge and a trend toward to a reduction of MBP during the same period of the day (P =.057). However, the clinical BP did not change after the single bout of MBSR. Therefore, a single bout of MBSR can potentially be an important tool for reducing CV risk in sedentary women with hypertension.

CONFLICT OF INTEREST

None.

FUNDING

This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Supeior – (CAPES) (88882.431082/2018-01).

TRIAL REGISTRY INFORMATION

The study protocol was approved by the Clinical Trials Registry ReBec (Registros Brasileiros de Ensaios Clínicos) and registered under number RBR-6jmwc8.

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