

## Evaluating lifestyle interventions' effects on the management of hypertension: A systematic review

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### Abstract

**Background:** The mainstay of treatment for hypertension is a change in lifestyle. Cross-sectional studies show that physical activity and exercise training are protective against cardiovascular disease. The goals of our study were to determine which lifestyle strategy is most useful for decreasing blood pressure in people with hypertension by comparing its efficacy with other methods.

**Method:** This systematic review is reported using the PRISMA treatments. We searched Embase, Cochrane, and PubMed for pertinent studies that were released between 2011 and 2020. We limited the scope of our searches to English-language publications and supplemented them with the information we had already discovered and the reference lists of reviewers. We included RCTs that contrasted the effects of lifestyle interventions on blood pressure reduction in adult hypertension patients.

**Result:** Six RCTs totaling 616 participants were considered in this systematic review (281 in the control groups and 335 in the intervention groups). Research was carried out in China, Australia, Sweden, USA, Canada (two studies), and China. Dietary approach, regular salt (sodium reduction), MBSR, yoga, and DASH + 12 weeks of exercise are among of the interventions that were employed.

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Conclusion: Changes in lifestyle resulted in a drop in blood pressure and changes in autonomic tone, as seen by training-induced reductions in heart rate. MBSR did not significantly lower ambulatory blood pressure in patients with untreated stage 1 hypertension as compared to a wait-list control group, either statistically or clinically.

**Keywords:** Blood Pressure; Systolic Blood Pressure; Diastolic Blood Pressure; Lifestyle Changes; Exercise

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## 1. Introduction

Hypertension is a major global public health issue. The number of persons with hypertension will continue to rise, approaching 1.5 billion by 2025 as populations age, lead unhealthy lifestyles, and gain weight (1). Research has demonstrated that uncontrolled hypertension is a powerful risk factor for serious cardiovascular events, such as myocardial infarction and stroke (2,3). Patients with prehypertension are more likely to develop chronic hypertension and cardiovascular disease than persons with normotension. First-line antihypertensive drug pharmacotherapy significantly lowers blood pressure (BP) (4), but it also comes with side effects, treatment resistance, and cost implications (5). Strategies that are universally accessible, economical, sustainable, and effective are required to prevent and treat hypertension.

The primary line of therapy for hypertension is lifestyle modifications. Exercise training and physical activity are protective against cardiovascular disease, according to cross-sectional data. However, interventional studies frequently find that training does not change traditional risk factors, such as blood pressure, blood lipids, diabetes, etc. to the extent that epidemiology predicts (6). The idea that exercise has to offer protection above and beyond these conventional indices has been prompted by this (7). Exercise training has been linked to decreased HRV (8) and protection against age-related declines in baroreflex function (9). These effects of exercise on ANS function and balance are pretty well established.

Several RCTs, systematic reviews, and meta-analyses have evaluated the impact of lifestyle therapies in lowering blood pressure. Several lifestyle therapies are recommended for the prevention and management of hypertension in developed countries (10–12). To give solid proof of the use of life style interventions, a research that can thoroughly compare the BP-lowering effects of various lifestyle interventions is desperately needed. Our study's objectives were to compare the effectiveness of several lifestyle strategies for lowering blood pressure in persons with hypertension and to identify the most beneficial one.

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## 2. Method

The Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) treatments is followed in the reporting of this systematic review (13).

We looked through Embase, Cochrane, and PubMed to find relevant research that was published between 2011 and 2020. We restricted our searches to English-language publications and added to them by looking through reviewers' reference lists and the material we had found.

RCTs comparing the impact of lifestyle therapies on blood pressure reduction in adult hypertensive patients were included in our analysis. Individuals with SBP  $\geq 140$  mm Hg or DBP  $\geq 90$  mm Hg who were not taking antihypertensive drugs were classified as hypertensive patients (14). Various life style treatments qualified as eligible interventions. Other lifestyle interventions or standard care were used as comparators. Studies that included people with a history of diabetes mellitus, heart failure, stroke, major illness, or cancer were disqualified. Research that addressed gestational hypertension were also disregarded.

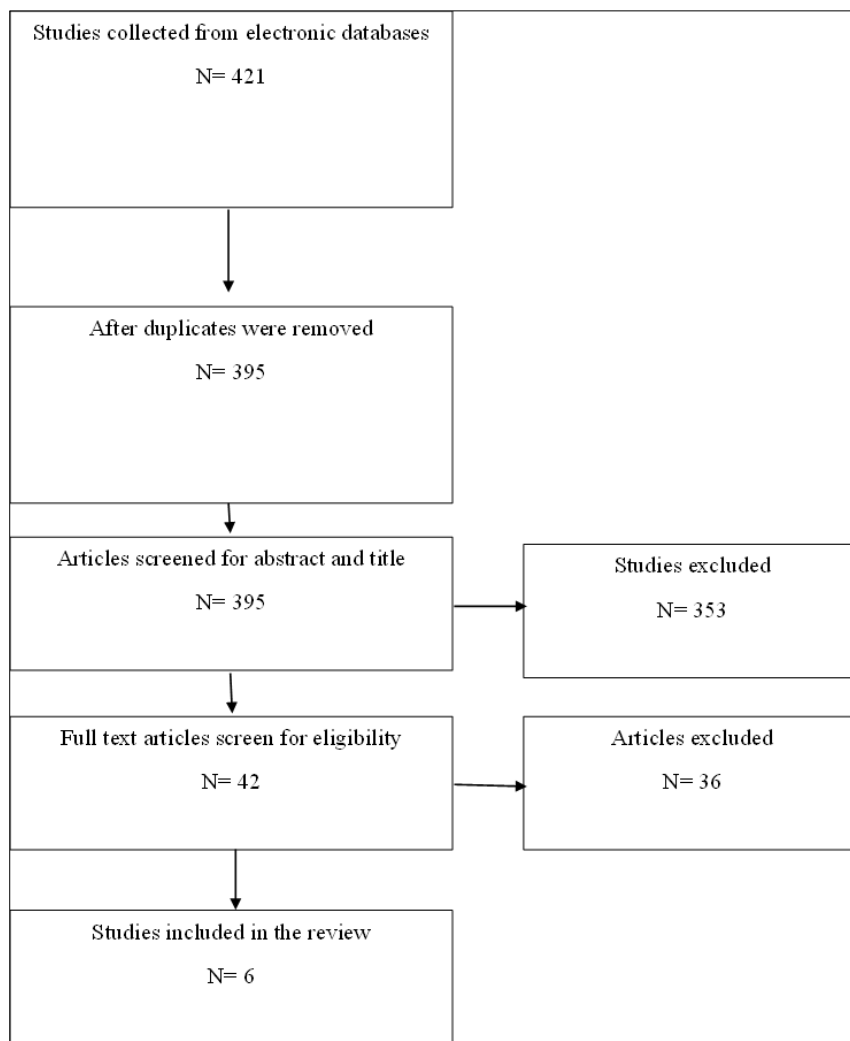
Four reviewers individually went through the abstracts and titles of every study that may be qualified. In order to find articles that satisfied all requirements for inclusion in the quantitative synthesis, four reviewers conducted full-text reviews. Discussions were used to settle disagreements. Every reviewer retrieved pertinent data twice from every qualifying study; disagreements were settled by discussion among the reviewers. We retrieved information on the study's technique, intervention, goal, and key findings.

### 3. Result

In this systematic review study we included 6 RCTs (Fig 1) with a total of 616 patients (281 in the control groups, and 335 in the intervention groups). Studies were conducted in Canada (2 studies), China, USA, Sweden, and Australia. Intervention used include; Dietary approach; Regular salt (sodium reduction); MBSR; Yoga; and DASH + 12 weeks exercise (Table 1).

According to Zou et al., 2017 (15) After eight weeks of randomization, the intervention group significantly reduced their SBP and scored better on physical health measures than the control group. There were no differences in the way that different groups used healthcare services. In Zhao et al., 2014 (16) study, when comparing the intervention group to the control group, there was a net decrease in SBP/DBP of -8.2/-3.4 mmHg. The study found a net decrease in SBP/DBP at -7.6/-3.5 mmHg after multiple imputations.

MBSR were used by 2 studies, in Blom et al., 2014 (17) study, there was no appreciable difference between the wait-list control and the intervention for any ambulatory BP measure. As per the secondary within-group analysis, only female participants in a sex analysis saw a little drop in BP after MBSR compared to baseline. While in Hughes et al., 2013 (18) study, those who were randomly assigned to MBSR had a 1.2 mm Hg increase in PMR and a 1.9 mm Hg drop in DBP; ambulatory BP decreased less with MBSR than with PMR.



**Figure 1** PRISMA consort chart of study selection

Yoga was used as an intervention in Wolff et al., 2013 (19) study, when comparing at home yoga to the control group, they discovered a 4.4 mmHg decline in DBP; however, neither BP nor self-rated Qol increased in the yoga at class group. Additionally, the self-rated Qol of home yoga group was considerably higher than that of the control group. in Edwards

et al., 2011 (20) study, HRR rose in both intervention groups from pre- to post-intervention, whereas waitlists exhibited no change, indicating a significant group by time interaction. Comparatively, the exercise and diet and exercise groups showed significant decreases in BP from pre- to post-intervention, but not the waiting. Linear regression demonstrated that the change in HRR highly predicted the BP post-intervention after controlling for pre-BP, age, gender, and BMI (Table 2).

**Table 1** Characteristics and main findings of the included studies

Citation	Country	Study groups and Sample size	Intervention	Method
Zou et al., 2017 (15)	Canada	Control, n = 30 Intervention, n = 30	Dietary approach	RCT
Zhao et al., 2014 (16)	China	Control group, n= 141 Intervention, n= 141	Regular salt (sodium reduction)	RCT
Blom et al., 2014 (17)	Canada	Control, n= 51 Intervention, n= 50	mindfulness-based stress reduction (MBSR)	RCT
Hughes et al., 2013 (18)	USA	Control, n= 17 Intervention, n= 21	MBSR	RCT
Wolff et al., 2013 (19)	Sweden	Control, n= 27 Intervention 1 (Yoga at class), n= 28 Intervention 2 (Yoga at home), n= 28	Yoga	RCT
Edwards et al., 2011 (20)	Australia	Control, n= 15 Intervention 1 (exercise), n= 25 Intervention 2 (exercise + diet), n= 12	Dietary approaches to stop HTN (DASH) diet + 12 weeks exercise	RCT

**Table 2** Aim and main findings of the included studies

Citation	Aim	Main findings
Zou et al., 2017 (15)	To assess the viability of a culturally appropriate dietary intervention for the management of HTN; to investigate the intervention's possible impact on BP and health-Qol.	The intervention was well received by the participants, who also followed the trial's instructions. There was a 5% loss rate due to follow-up. Eight weeks after randomization, the intervention group had higher physical health scores and more significant decreases in SBP than the control group. There were no variations in the use of healthcare services by group.
Zhao et al., 2014 (16)	To assess the impact of a high-potassium, low-sodium salt alternative on decreasing BP	After controlling for baseline BP and other covariates, the PP analysis showed that after the three-month intervention period, the net reduction in SBP/DBP in the intervention group compared to the control group was -8.2/-3.4 mmHg. After multiple imputations, study revealed a net decrease in SBP/DBP at -7.6/-3.5 mmHg. Additionally, the whole BP distribution demonstrated a decrease in SBP/DBP overall, and the percentage of patients with BP under control was considerably greater in the salt replacement group than in the standard salt group.

Blom et al., 2014 (17)	Investigating the effectiveness of an 8-week MBSR treatment for decreasing BP in individuals with untreated stage 1 HTN.	For every ambulatory BP measure, there was no discernible difference between the wait-list control and the intervention. Only female individuals in a sex analysis showed a little decrease in BP following MBSR as compared to baseline.
Hughes et al., 2013 (18)	To find out if the BP reductions linked to MBSR are greater than those shown in an active control condition with PMR training.	Individuals who were randomized to MBSR showed a 1.9 mm Hg decrease in DBP and a 1.2 mm Hg rise in PMR. There was no greater drop in ambulatory BP with MBSR compared with PMR.
Wolff et al., 2013 (19)	The study examined the impact of two yoga treatments on the Qol and BP of individuals receiving primary healthcare who had been diagnosed with HTN.	There was a 4.4 mmHg drop in DBP in the home yoga group as compared to the control group, but neither BP nor self-rated Qol improved in the class yoga group. Furthermore, as compared to the control group, home yoga group's self-rated Qol significantly improved.
Edwards et al., 2011 (20)	The impact of lifestyle modifications on ANS function in individuals with increased BP was examined by the authors.	Heart rate recovery revealed a significant group by time interaction; whereas waitlists showed no change, both intervention groups' HRR increased from pre- to post-intervention. Comparably, from pre- to post-intervention, there were notable drops in BP seen in the exercise and diet and exercise groups, but not in the waitlist. After adjusting for pre-BP, age, gender, and BMI, linear regression showed that the change in HRR strongly predicted the BP post-intervention.

#### 4. Discussion

In this study, we sought to identify the most beneficial lifestyle intervention and compare its efficacy in lowering BP in persons with pre-hypertension to established hypertension.

DASH intervention was proven to lower BP and enhance health-related Qol. When MBSR was compared to a wait-list control group in untreated, stage 1 hypertension patients, ambulatory BP was not statistically or clinically significantly lowered. Untested is the possibility that MBSR might help individuals with treated hypertension reduce their BP by increasing adherence. A brief yoga regimen that the patient may follow at home appears to have both antihypertensive and beneficial effects on self-rated Qol. Lifestyle modifications caused training-induced BP reductions and changes in autonomic tone, as measured by HRR.

A 3 mmHg drop in SBP was predicted to result in a 4% decrease in overall mortality, a 5% drop in coronary heart disease mortality, and an 8% drop in stroke mortality (21). A persistent drop in DBP of 2 mmHg was shown to be associated with a 6% lower risk of coronary heart disease, a 15% lower risk of stroke and transient ischemic attack, and a 17% lower prevalence of diastolic hypertension, according to another research (22).

According to the results of the Zou et al. (2016) experiment, patients health-related Qol, particularly its physical components, may be improved by the DASH intervention. There might be several factors involved in the mechanism of the intervention's possible impacts on the sense of health-related Qol. First, as opposed to emphasizing calorie restriction or particular nutrient limitations, the DASH diet concentrates on a dietary pattern (23). According to the American Dietetic Association, eating enjoyment and health-related Qol can be preserved as BP is lowered with the DASH diet (24). Second, TCM dietary treatment takes into account the traditional health beliefs and cultural preferences of Chinese Canadians, which may improve the sense of health-related Qol and result in high intervention satisfaction (25).

The 2013 study by Wolff et al. adds to the body of knowledge on yoga and hypertension by analyzing the benefits of yoga in a primary care setting—where the majority of patients receiving treatment for hypertension are treated. The patient's physician at the medical facility may readily instruct them on the shorter intervention. Yoga lowers BP, according to earlier research (26,27). Nevertheless, it is challenging to compare the yoga therapies' efficacy because of the variations in their designs and durations, which ranged from three to twenty weeks. Additionally, a few of the studies included other interventions, including dietary modifications, in addition to the yoga treatment (26,28).

The main treatments for elevated BP are thought to be dietary modifications and increased physical activity. Intervention studies have shown that following a DASH diet (29) and exercise training (30,31), BP is significantly reduced. Less is known about the mechanisms underlying this impact, however it has been proposed that neurohormonal and structural changes and a decrease in peripheral vascular resistance are responsible (6). Exercise training is known to have an impact on the activity of the ANS. Research has demonstrated that endurance training reduces sympathetic activation in individuals with normotension and has been linked to a drop in BP in HTN patients (32).

#### *List of abbreviation*

- BP, Blood pressure
- Qol, Quality of life
- HTN, hypertension
- PMR, progressive muscle relaxation
- SBP, systolic blood pressure
- DBP, Diastolic blood pressure
- MBSR, mindfulness-based stress reduction
- DASH, Dietary approaches to stop HTN
- RCT, randomized controlled trial
- ANS, autonomic nervous system
- HRR, heart rate recovery

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## 5. Conclusion

We draw the conclusion that DASH interventions lower BP and enhance health-related Qol. In individuals with untreated stage 1 hypertension, ambulatory BP did not substantially decrease with MBSR compared to a wait-list control group, either statistically or clinically. A quick yoga practice that the patient may perform at home seems to have positive impacts on self-rated Qol and to have antihypertensive properties. Lifestyle adjustments led to alterations in autonomic tone as shown by HRR and BP decreases brought on by training.

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## Compliance with ethical standards

### *Disclosure of conflict of interest*

No conflict of interest to be disclosed.

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