

# Acupuncture therapy improves vascular hemodynamics and stiffness in middle-age hypertensive individuals



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## ABSTRACT

Acupuncture (ACU) is becoming a more common practice among hypertensive individuals. However, the reported therapeutic effects of ACU in lowering brachial blood pressure (BP) are ambiguous. Therefore, evaluating more sensitive markers of arterial functioning might unveil the protective effects of ACU on hypertension. We examined the effects of an 8-week ACU therapy intervention on vascular hemodynamics and stiffness in middle-age hypertensive individuals. Participants were randomly assigned to either ACU ( $n = 23$ ) or a control group ( $n = 22$ ). Brachial and aortic BP, wave reflection (Alx) and arterial stiffness (SI) were measured before and after 8 weeks. There was a significant group  $\times$  time interaction ( $P < 0.05$ ) for brachial and aortic BP, Alx and SI which significantly decreased ( $P < 0.05$ ) following ACU but not after control. ACU led to reductions in brachial and aortic BP, wave reflection and arterial stiffness in middle-age hypertensive individuals. ACU might be effective in the prevention and treatment of hypertension.

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## 1. Introduction

Hypertension (HTN), characterized by increased brachial blood pressure (BP), affects about one billion individuals worldwide and is considered the most important risk factor for premature cardiovascular disease (CVD) [1]. Current recommendations for the control of HTN include the use of pharmacological treatment as well as lifestyle changes such as diet and exercise training [2]. However, an effective decrease in brachial BP is limited by the cost, side effects and safety concerns of antihypertensive drugs [3]. Furthermore, long-term compliance with lifestyle modifications is difficult to maintain in most individuals. Therefore, modalities of complementary and alternative medicine, such as acupuncture (ACU), are becoming a more common practice among hypertensive individuals [4].

ACU has been used in both western and eastern countries for the management of many diseases, including HTN [5]. However, these therapeutic effects of ACU in lowering brachial BP are somewhat

ambiguous. Recent systematic and meta-analytic reviews suggested that ACU can decrease brachial BP [5–7] while others have concluded that there is little or no effect [8,9]. Interestingly, brachial BP might underestimate the effects of ACU on HTN control, and hence the evaluation of other more sensitive markers of cardiovascular functioning might unveil the cardioprotective effects of ACU. For instance, aortic systolic BP (SBP), arterial stiffness and pulse wave reflection (augmentation index, Alx) more accurately reflect the health of the aorta and loading conditions of the heart's left ventricle and, thereby, are better markers of cardiovascular risk [10–13] and therapeutic targets for HTN [14–16] than brachial BP. Yet, evidence on the effects of ACU on aortic hemodynamics and stiffness is limited and unclear. ACU has been shown to acutely decrease Alx without altering aortic BP in healthy individuals [17]. Previous studies reported that aortic stiffness shows a trend to decrease after a single session of ACU in healthy individuals [18,19]. There is also evidence that ACU can acutely enhance the nitric oxide (NO) generation, blood flow and distensibility of peripheral arteries in young individuals [20,21]. Thus, we hypothesized that ACU therapy, would improve aortic hemodynamics and arterial stiffness in hypertensive adults. Therefore, the aim of the study was to examine the effects of 8 weeks of ACU therapy on aortic BP, wave

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reflection, and stiffness in middle-aged individuals with HTN.

## 2. Methods

### 2.1. Participants

Forty-five (age 47–63 years) middle-age individuals (men = 18, women = 27) with HTN [140–179 mmHg brachial SBP or 90–109 mmHg diastolic BP (DBP)] from the Magnitogorsk, Russia area participated in the present study. HTN was diagnosed by a physician prior to participation on the study. All women were postmenopausal, which was defined as the absence of menstruation for at least 1 year. Participants were excluded if they had pulmonary, renal, adrenal, pituitary, severe psychiatric, thyroid, or cardiovascular diseases other than HTN and the use medication or hormone replacement therapy during the 6 months prior the study. Participants were also excluded if they were smokers. In addition, those who attended psychological or physical therapy, had a history of steady exercise or received exercise training and dietary changes in the last year, were excluded to avoid potential confounders in the present trial. All participants received complete information about the study design and provided written informed consent. All protocols were approved by the Institutional Review Board and carried out in accordance with the Declaration of Helsinki.

### 2.2. Study design

We used a randomized controlled parallel experimental design. Following an initial screening and familiarization session of study

tests and procedures, eligible individuals were randomly assigned to an ACU group or non-intervention control group (Fig. 1). Allocation was stratified for brachial SBP [ $>140 < 160$  mmHg ( $n = 21$  in ACU and  $n = 21$  in control group) or  $\geq 160 < 180$  mmHg ( $n = 2$  in ACU and  $n = 1$  in control group)], and the sequence was generated by a computer-based number. Measurements were collected at baseline and after 8 weeks during the same time of day ( $\pm 1$  h) in the morning following an overnight fast, abstinence from caffeinated drinks and alcohol and between 48 and 72 h after the last ACU session. Cardiovascular measurements were collected in a quiet temperature-controlled room ( $22\text{--}24^\circ\text{C}$ ) following at least 10 min of rest in the supine position. Participants were instructed not to alter their regular lifestyle habits during the study period (verified through food/physical activity logs).

### 2.3. Acupuncture intervention

Participants in the ACU group were treated with standardized ACU 3 x week for an 8-week period. We used disposable stainless steel needles (diameter: 0.20 mm, length: 30 mm). In each session, participants were given deqi sensation via manipulation right after inserting needle into the skin, plus 20 min of needle-retaining time. The ACU points used were bilateral ST36, ST37, PC 5, PC6, LR3, SP4, LI11 based on prior literature on hypertensive individuals [22].

### 2.4. Control intervention

Participants in the control group made no changes in their lifestyle, and were not provided any treatment during the study

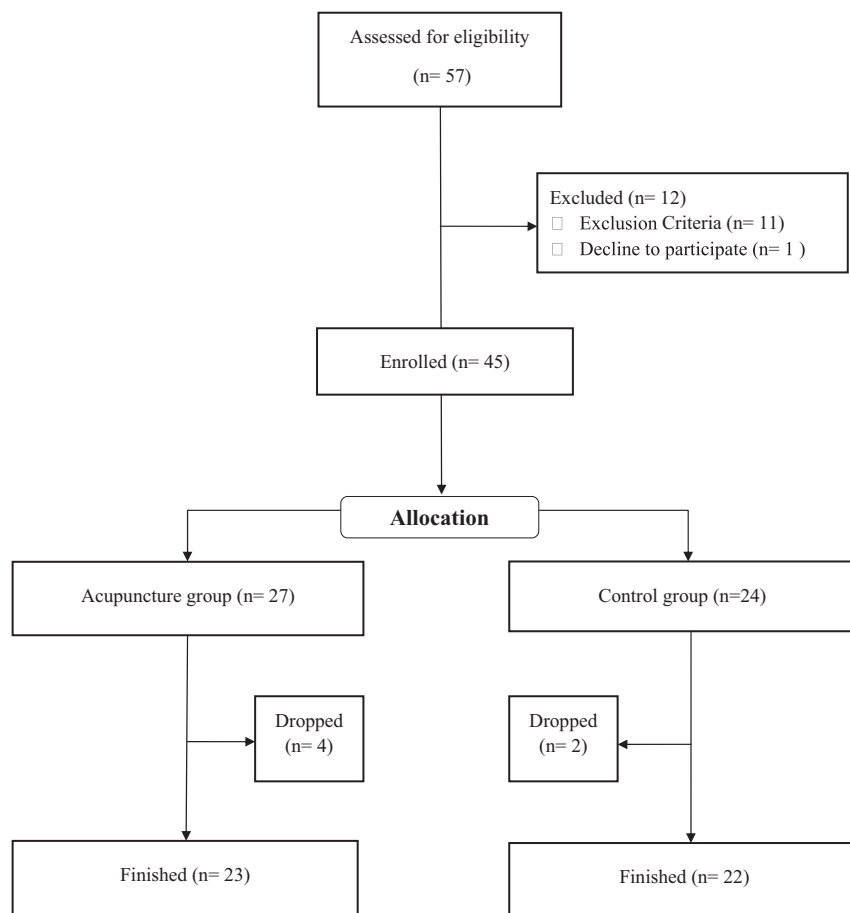


Fig. 1. Diagram for the experimental study.

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