

Exercise, Weight Management, and DASH Diet Are Superior to DASH Diet Alone for Lowering Blood Pressure

Blumenthal JA, Babyak MA, Hinderliter A, et al. Effects of the DASH diet alone and in combination with exercise and weight loss on blood pressure and cardiovascular biomarkers in men and women with high blood pressure: The ENCORE Study. *Arch Intern Med* 2010;170:126–35.

Study Overview

Objective. To assess the incremental effectiveness of adding exercise and weight management to the Dietary Approaches to Stop Hypertension (DASH) diet for the treatment of hypertension.

Design. Randomized, blinded controlled trial.

Setting and participants. The study was conducted at a single institution in the United States. Subjects were women and men aged 35 years or older (mean age, 52 years) who were overweight (body mass index, 25–40), sedentary, and had above-normal blood pressure (130–159 mm Hg systolic or 85–99 mm Hg diastolic). Potential subjects were excluded if they took antihypertensive medication, took any other medication known to affect the cardiovascular system, or had other medical comorbidities that would make trial participation unsafe. Of 449 eligible patients who underwent screening for inclusion, 305 were not randomized due to physiologic parameters outside the study specifications (162), dietary reasons (12), patient request (87), and for other reasons (44). The selection process ultimately yielded 144 patients who were randomized.

Intervention. Patients were randomized to receive either DASH diet alone (DASH-A), DASH diet plus exercise and weight management (DASH-WM), or usual care. DASH-A

consisted of a 2-week controlled feeding period followed by 14 weeks of dietary instruction that included weekly 30- to 45-minute group sessions with a nutritionist. Patients in DASH-A were instructed not to exercise or try to lose weight. DASH-WM consisted of DASH-A dietary instruction plus thrice-weekly supervised exercise sessions and a cognitive-behavioral weight loss intervention incorporated into the weekly nutritionist session. Each exercise session lasted 45 minutes and included biking, walking, and/or jogging. Each intervention arm lasted 4 months.

Main outcome measures. The primary outcome was blood pressure (measured both in clinic and via ambulatory blood pressure monitor). Secondary outcomes were pulse wave velocity and baroreflex sensitivity (as measures of arterial stiffness), flow-mediated dilation (as a measure of endothelial dysfunction), and left ventricular mass index (assessed via echocardiography). The baseline values of each measurement were compared with values at the conclusion of the 4-month study period.

Main results. DASH-WM reduced clinic-measured blood pressure by a mean of 16.1/9.9 mm Hg, a greater amount than DASH-A (11.2/7.5 mm Hg; $P < 0.05$ for comparison with DASH-WM) and usual care (3.4/3.8 mm Hg, $P < 0.001$). Findings for blood pressure measured via ambulatory monitoring were similar. Compared with DASH-A,

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DASH-WM was also associated with statistically significantly greater improvements in pulse wave velocity, baroreflex sensitivity, and left ventricular mass index.

Conclusion. Compared with DASH diet alone, DASH diet plus exercise and weight management is associated with greater improvements in blood pressure and other indicators of cardiovascular risk. Given the study's short duration and lack of long-term health outcomes, further investigations may provide a better sense of ultimate health impact. Despite these limitations, this study adds to growing evidence that supervised exercise may be an essential component of optimal cardiovascular care.

Commentary

Recommendations of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC-7) call for lifestyle modification as first-line treatment of hypertension [1]. While JNC-7 guidelines support the DASH diet, this diet has had its greatest blood pressure-lowering effects in short-term feeding trials [2,3]. By comparison, the impact of the DASH diet on blood pressure has been relatively small in trials among free-living patients, with the PREMIER trial showing a statistically nonsignificant 0.6-mm Hg difference in blood pressure associated with the DASH diet [4]. There has therefore been uncertainty about the effectiveness of the DASH diet in the general population of patients with hypertension.

The current investigation by Blumenthal and colleagues is the first to investigate the benefit of exercise and weight management in addition to the DASH diet among free-living patients with above-normal blood pressure. Compared with both DASH alone and usual care, DASH plus exercise and weight management (DASH-WM) produced greater improvements in blood pressure and other markers of cardiovascular risk over a 4-month period. The magnitude of blood pressure lowering seen in the DASH-WM arm was equivalent to what would be expected from starting a high-dose antihypertensive medication [5]. In addition, patients receiving DASH-WM lost a mean of 8.7 kg over the 4-month study period (compared with 0.3 kg among patients receiving DASH alone and a 0.9-kg gain among patients receiving usual care; $P < 0.001$ for comparisons to DASH-WM). While the exercise intervention was intensive, including 3 supervised sessions per week in addition to nutritionist sessions, adherence to this protocol was high (median of 90% of sessions attended, with 94% of exercise time within the target heart rate range) among patients randomized to this treatment. While study participants were volunteers, this high adherence to supervised exercise suggests the feasibility of its incorporation into patients' lives.

This study has limitations. Study enrollment was selective, with fewer than one-third of initially eligible volunteers ultimately being included in the trial. Because participants randomized to DASH alone or to usual care were asked *not* to engage in exercise or weight loss efforts, these comparison groups are somewhat artificial. In actual clinical practice, such patients would be likely to receive advice to exercise and lose weight (even if supervised exercise and intensive nutrition counseling were not available). The short duration of the trial and the lack of ultimate health outcomes (eg, cardiovascular events and mortality) limit validity of drawing conclusions about long-term health impacts. On the other hand, the intermediate outcomes assessed in this study have been associated with improvements in ultimate health outcomes in other settings [6,7].

Applications for Clinical Practice

This study provides important evidence that exercise and weight management enhance the effectiveness of the DASH diet for the initial treatment of above-normal blood pressure. If these interventions can be shown to produce benefits in health outcomes over a longer time frame and in a less selectively chosen patient population, payers, health system managers, and policy makers may consider adding supervised exercise and more intensive nutritional counseling to currently reimbursed treatment protocols for high blood pressure.

—Review by Mark W. Friedberg, MD, MPP

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