BBs and Bullets

The Impact of Dietary Factors on Blood Pressure

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A n impressive body of evidence supports the concept that multiple dietary factors affect blood pressure. Typically, the blood pressure response to manipulation of a single nutrient is modest and heterogeneous; that is, the response can vary by baseline nutrient intake, baseline blood pressure, demographic factors, genetic polymorphisms, and other host factors. In this setting, the search for new dietary factors is fraught with hazards. The risk of false-negative results is high, especially in underpowered clinical trials, as is the risk of false-positive results, especially in observational studies that must deal with the treacherous issue of confounding.

In addition to sodium intake, potassium intake, weight, and alcohol consumption, other diet-related factors likely affect blood pressure. For instance, preliminary evidence suggests that an increased intake of protein and of monounsaturated fats might also reduce blood pressure. Will the likely impact of new factors be substantial (a “bullet”) or modest (a “BB”)? Results from the Dietary Approaches to Stop Hypertension (DASH) trial have raised the hope that bullets are plausible. However, the impressive effects of the DASH diet most certainly resulted from the combined impact of several nutrients with modest effects on blood pressure rather than from a single nutrient with large effects. Still, because even a modest population-wide reduction in blood pressure (eg, 3 mm Hg in systolic blood pressure in nonhypertensives) can lead to substantial reductions in cardiovascular disease, the search for additional dietary factors is clearly worthwhile. A major impediment, of course, is that the detection of such modest effects typically requires clinical trials with large sample sizes because of the inherent variability of blood pressure measurements.

Is the effect of vitamin C on blood pressure a BB, a bullet, or neither? Block et al present results from a depletion-repletion study in which low plasma levels of ascorbic acid, measured after 1 month on a vitamin C–depleted diet, were associated with higher levels of blood pressure. The “depletion” and “repletion” versions of the study diets provided 9 and 117 mg vitamin C/d, respectively. Skeptics may point out the complexity of the design, including the lack of baseline blood pressure measurements and the uncertain effects of the vitamin C–replete diet on subsequent blood pressure.

The interpretation of plasma ascorbic acid levels is not straightforward and might be subject to confounding. The authors hypothesize that plasma levels after a 1-month period of depletion reflect low total body stores. In addition to body stores and dietary intake of vitamin C, a host of metabolic and physiological factors, some known and others unknown, may determine plasma levels and potentially confound an association with blood pressure. For example, the well-known association of smoking with reduced ascorbic acid levels might reflect high utilization or turnover of vitamin C in response to inflammation or oxidative damage (ie, processes that are increasingly associated with chronic diseases).

If vitamin C intake does affect blood pressure, a critical issue is the shape of the dose-response relationship. Is the blood pressure response to vitamin C limited to correction of an obvious deficiency state? Or does supplementation beyond an adequate intake of vitamin C further lower blood pressure? Previous trials that tested the impact of pill supplementation with ≥500 mg vitamin C have been extraordinarily inconsistent; effect sizes have ranged from nil to >10 mm Hg in systolic blood pressure. The study by Block et al does not address the issue of high-dose supplementation. Rather, this study presents evidence of an inverse association of blood pressure with plasma ascorbic acid levels while participants consumed an extremely low intake of vitamin C. This level of vitamin C intake, namely 9 mg/d, roughly corresponds to the fifth percentile of intake in the Second Health and Nutrition Examination Survey [NHANES] II; the average plasma level of ascorbic acid was 26.9 μmol/L, which is close to the cutpoint of the lowest quartile for men in the NHANES II.

Could vitamin C contribute to the blood pressure–lowering effect of the DASH diet? Neither results from the DASH trial nor results from the Block et al study can answer this question. In the DASH trial, the 2100-kcal level of the control diet provided 133 mg vitamin C/d, the fruits and vegetables diet provided 202 mg vitamin C/d, and the DASH (combination) diet provided 266 mg vitamin C/d. Although it is tempting to link this gradient in vitamin C intake with the stepwise reductions in blood pressure across these diets, a
gradient in dietary intake was evident for many nutrients, such as folate.\textsuperscript{11} In addition, the level of vitamin C in the control diet of the DASH trial exceeded that of both the depletion and repletion diets in Block et al.\textsuperscript{6}

In summary, it remains unclear whether an increased intake of vitamin C reduces blood pressure. However, even without conclusive evidence of a direct beneficial effect of vitamin C, the DASH diet with its ample supply of vitamin C and other nutrients is a prudent choice to reduce blood pressure.

References


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