

Salt Reduction for Preventing Hypertension and Cardiovascular Disease

A Population Approach Should Include Children

Jeffrey A. Cutler, Edward J. Roccella

Many lines of investigation have led to overwhelming evidence for a causal relationship between dietary salt intake and blood pressure levels in adults. Importantly, these include numerous randomized clinical trials of salt reduction that have been the subject of several meta-analyses.¹ In children age ≥ 2 years, a previous review of 37 observational and intervention studies concluded, "the results suggest that higher sodium intake is related to higher BP in children and adolescents."² He and MacGregor³ have now conducted the first meta-analysis of salt reduction trials in children and adolescents and have clearly demonstrated that "modest reduction in salt intake causes immediate falls in blood pressure." They conclude that such effects "if continued, may well lessen the subsequent rise in blood pressure with age."

One may ask, why does any of this matter? The reductions in blood pressure were modest, and no hard disease end point results were documented. The importance is based on 3 relationships: (1) the moderately strong correlation of blood pressure in childhood with blood pressure in adulthood⁴; (2) the association of blood pressure with early atherosclerosis during the second decade of life⁵; and (3) intriguing evidence for a specific early programming effect between salt intake in infancy and blood pressure later in life.⁶ The latter relationship is supported by experimental evidence in animal models, but more research is needed.

Furthermore, in virtually every population throughout the world except those totally unacculturated to an industrialized lifestyle, blood pressure rises with increasing age. This results in rising hypertension prevalence, especially from middle age onward. In the United States, more than half of adults >65 years of age have hypertension.⁷ Remarkably, the residual lifetime risk at age 55 years for onset of hypertension is 90%, which means that of persons who live long enough, the vast majority will develop hypertension.⁸ When detection and treatment of hypertension is combined with other modifiable

risk factors, it provides a widely accepted method of predicting risk and preventing cardiovascular complications.

Most hypertension control programs have been targeted at those with greater risk, such as older people and those with multiple risk factors. The rationale has been that the benefit of intervention is greatest in those with the largest absolute risk. Although the major acquired cardiovascular diseases first appear in adults, their origins as noted above occur in childhood. Accordingly, the greatest long-term potential to reduce the conditions that lead to rising arterial blood pressure with increasing age is to initiate prevention activities in youth. This is a public health strategy aimed at preventing or slowing the progression of rising blood pressure altogether. Public health approaches to disease control are aimed at reducing the public's exposure or vulnerability to a vector or causative agent. These approaches can provide what seems to be a small effect in individuals but a significant reduction in population risk. For example, Cook et al⁹ showed that a 2-mm reduction of diastolic blood pressure in the population of 35- to 64-year-old persons would result in decreasing the prevalence of hypertension by 17%, the risk of stroke by 14%, and the risk of coronary heart disease by 6%. A total of 2 mm Hg may seem insignificant in 1 patient, but when applied to a population, it will yield startling societal benefits.

This new meta-analysis encompasses 13 controlled trials published in English conducted over the past 25 years, all but 2 reporting the use of random allocation. Two intervention approaches were used to reduce salt intake, based either on counseling caregivers for behavior change or on supplying food or water with reduced salt content. In most trials, the success of intervention was quantified objectively by using a measure of urinary sodium excretion. Some trials were double blind, and in most, the blood pressure observers were kept unaware of treatment assignment. For their meta-analysis, He and MacGregor³ used state-of-the-art methods, including thorough search methods, duplicate data abstraction, both fixed- and random-effects models, tests for publication bias, and appropriate sensitivity analyses.

For ease of interpretation and to make developmental sense, the authors divided the trials into those conducted in infancy and those in older children and adolescents. Among the latter (mean ages for individual trials from 8 to 16 years), estimated salt intake was reduced 42%, and blood pressure was lowered by 1.2/1.3 mm Hg after a median duration of 4 weeks. Excluding the nonrandomized trial or the 2 trials in which the effect on salt intake was very small had no substantial effect on the pooled results. In the 3 trials in infants (1 of which seemed to be nonrandomized), sodium

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From the Division of Epidemiology and Clinical Applications and the Office of Prevention, Education, and Control, National Heart, Lung, and Blood Institute, National Institutes of Health, Bethesda, Md.

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Correspondence to Jeffrey A. Cutler, 6701 Rockledge Dr, MSC-7938, Bethesda, MD 20892. E-mail cutlerj@nhlbi.nih.gov

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excretion was reduced by an estimated 54%, with a decrease in mean systolic pressure of 2.5 mm Hg. The data are dominated by the landmark randomized trial conducted by Dutch investigators 25 years ago, but importantly are reinforced by a recent smaller randomized trial from Israel. It would have been useful for both subsets of trials if the authors had provided a summary of any measurements of potentially confounding changes in diet or other lifestyle factors. However, the absence of significant heterogeneity in blood pressure effects across the trials, as well as the fact that ≥ 1 trial in each subset was double blind, provides reassurance that the data are not confounded by such changes.

We believe these findings that support a prevention strategy beginning in childhood are critically important for additional reasons. In industrialized nations and in many emerging economies, heart disease and stroke are the primary cause of death and disability. Moreover, heart disease and stroke needlessly cost society billions of dollars in medical care expenses, as well as lost productivity, and produce decrements in quality of life. One of the primary driving forces for the global cardiovascular disease epidemic is raised arterial blood pressure.¹⁰ In adults, the onset of cardiovascular disease may present as an acute episode. Society has invested heavily in biomedical research aimed at treating such manifestations of cardiovascular disease, and the investment has yielded brilliant technology. A variety of cardiovascular treatments have helped many people survive their ordeal and go on to lead productive lives. But these interventional technologies cannot be applied universally, are priced beyond the reach of many individuals and societies, and are far from completely effective. This latter limitation includes blood pressure reduction in hypertensive patients: cardiovascular risk remains greater than in those who never developed this condition.

Current US dietary guidelines¹¹ already recommend that persons age ≥ 2 years consume < 2300 mg of sodium (equivalent to 5.8 g of salt). He and Macgregor³ present evidence that considerably strengthens the science base for this recommendation and suggest that a primary prevention strategy based on dietary salt reduction, initiated in childhood, is capable of reducing exposure to an important cardiovascular risk factor. The fall in blood pressure was almost immediate and has been shown to persist for many months in older children¹² and for over a decade when begun in infancy.⁶

The action needed is to modestly and persistently reduce salt in the food supply, particularly snack foods and fast foods, an increasing staple of the diets of children and youth,

as well as many canned and processed foods. Slowly reducing dietary salt will give populations time to adjust to the taste of lower-salt food. This phenomenon is well documented in adults.¹³ This important public health strategy, designed to slow or prevent the rising arterial blood pressure that accompanies aging, complements clinical strategies in pursuit of the goal of improving national and international cardiovascular health, now and for generations to come.

Disclosure

None.

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