Population-Based Approaches to Salt Reduction Could Have Dramatic Effects on Cardiovascular Health

Bibbins-Domingo K, Chertow G, Coxson P, et al. Projected effect of dietary salt reductions on future cardiovascular disease. N Engl J Med 2010;362:590–9.

Study Overview

Objective. To determine the benefits of a population strategy to reduce dietary salt intake by 3 g (1200 mg of sodium) daily using simulation models.

Design. Simulated models using the Coronary Heart Disease Policy Model and population data.

Methods. Authors simulated the population effects of dietary salt reduction using a validated computer-simulation, state-transition (Markov cohort) model for U.S. adults aged 35 to 84 years. National datasets were the source of data on coronary heart disease (CHD) incidence and natural history as well as risk for CHD, categorized by age, sex, systolic blood pressure, use or nonuse of antihypertensive medications, smoking status, HDL cholesterol, LDL cholesterol, and presence or absence of diabetes mellitus. Authors extended the CHD models to stroke and further estimated specific CHD and stroke models for black and non-black populations, using race-specific data from the National Health and Nutrition Examination Study (NHANES). Randomized clinical trials and meta-analyses of trials provided the data on the effect of salt reduction on blood pressure. All results were compared with the CHD effects that would be expected from other population interventions intended to reduce smoking rates and environmental tobacco exposure by 50%, decrease body mass index (BMI) by 5% among obese adults, treat hypertension with reductions in blood pressure equivalent to that achieved in the ALLHAT trial, and treat high cholesterol in individuals with low to intermediate risk for CHD, in accordance with the guidelines of the National Cholesterol Education Program. Sensitivity analyses adjusted the estimated effect of salt reduction on blood pressure and CHD/stroke and included race-specific risk factor estimates.

Main outcome measures. Incident cases of CHD, stroke, and myocardial infarction; mortality from any cause; and cost-effectiveness of dietary salt reduction.

Main results. Salt reduction by 3 g per day would reduce incident cases of CHD by 60,000 to 120,000, incident stroke by 32,000 to 66,000, and incident myocardial infarction by 54,000 to 99,000. Annual deaths from any cause would decrease by 44,000 to 92,000, with a gain of 194,000 to 392,000 quality-adjusted life years. Health care cost savings would be $10 to $24 billion annually. Overall benefits of dietary salt reduction would be similar, if not greater, than what would be expected with reductions in smoking and environmental tobacco exposure, reductions in BMI among obese adults, treatment of high cholesterol among those with low to intermediate CHD risk, and treatment of hypertension with medications. All racial and age subgroups would benefit from salt reduction, but the most significant improvements would accrue among blacks and middle-aged to elderly populations. Women would have a greater reduction in strokes than men. Reductions would be substantial even with limited dietary salt reduction of 1 g, with an estimated decrease in deaths from any cause of 15,000 to 32,000. In sensitivity analyses, using more modest projected effects on blood pressure and CHD from salt reduction, substantial benefits would be achieved.

Conclusion. Dietary salt reduction would provide substantial reductions in CHD, stroke, and mortality and would be cost-effective.

Commentary

Salt intake is high in the United States, with women consuming over 7 g per day and men over 10 g [1]. Recommendations call for intake of less than 5.8 g per day and less than 3.7 g per day for most adults [2]. Research has consistently shown that dietary salt reduction can achieve health benefits, especially from reductions in blood pressure [3,4]. However, achieving dietary salt reduction is difficult. Most salt intake arises from processed foods rather than added salt, and intensive educational interventions alone have measurable but very limited effects on blood pressure reduction [5].

Several countries, including Japan, Finland, Ireland, and the United Kingdom, have implemented successful population strategies to reduce dietary salt intake, working with food companies and through regulation [6]. New York

City recently announced a plan to reduce dietary salt by 25% in packaged and restaurant foods over 5 years, using a voluntary approach in collaboration with food companies [7]. These interventions serve as the primary basis for the study by Bibbins-Domingo et al, which found that modest reduction in dietary salt would have profound impacts on overall incidence of CHD, stroke, myocardial infarction, and all-cause death, with substantial cost savings at the same time. Benefits would be greater for the populations, such as older age-groups and blacks, who currently bear the greatest burden of CHD and stroke. These benefits stand up to multiple sensitivity analyses that vary the presumed benefit of dietary salt reduction, and even minimal salt reduction would lead to impressive improvements in health. The estimated improvements in health would be similar to what could be achieved through other widely recognized public health targets, such as a reduction in smoking, weight loss, treatment of hypertension with medications, and use of statins for the primary prevention of CHD.

Modeling studies should always be viewed with some skepticism because of their dependence on assumptions. Modeling cannot integrate all complicated risk factors and components that ultimately impact disease incidence and natural history (eg, BMI). Some of the underlying assumptions also could be wrong. For example, the authors estimated that the effects of dietary salt reduction on blood pressure would be linear from 0 to 3 g when data exist to contradict this finding [4]. They also used risk factor estimates from the Framingham Heart Study cohorts in models for black men and women. These cohorts have limited racial and ethnic diversity, and their application to minority populations seems inappropriate. Authors did incorporate sensitivity analyses using race-specific estimates, however, and these analyses were consistent with the main results. Some inadequate or inaccurate assumptions could specifically lead to underestimates of benefits. Authors included only the benefits of salt reduction derived from blood pressure reduction when other benefits, such as a reduction in congestive heart failure exacerbations, would be expected. Children were excluded from the analysis, and salt reduction at a younger age may lead to compounded benefits over time [8].

Recent evidence has reassuringly found concordant results for the effect of dietary salt. A study by Danaei et al estimated that 102,000 deaths annually were attributable to high dietary salt intake [9]. Another simulation study found that a reduction of dietary salt intake to the average recommended daily level would gain 312,000 quality-adjusted life years at a savings of $18 billion annually in health care costs [10].

Overall, the findings of Bibbins-Domingo et al call for strong consideration of population strategies to reduce dietary salt. The limited success of individually focused interventions call for a broader approach that can achieve reductions in the salt content of processed foods and foods prepared away from home. The efforts of New York City and hopefully other municipalities will allow for a direct assessment of such efforts.

Applications for Clinical Practice

Clinicians should continue to recommend that patients reduce their salt consumption, in accordance with guidelines. However, clinicians should recognize the limitations of individually focused approaches and encourage the adoption of more broad-based dietary salt reduction programs.

—Review by Jason P. Block, MD, MPH

References

1. Briefel R, Johnson C. Secular trends in dietary intake in the United States. Annu Rev Nutr 2004;24:401–31.
2. Application of lower sodium intake recommendations to adults—United States, 1999–2006. MMWR Morb Mortal Wkly Rep 2009;58:281–3.
3. He FJ, MacGregor GA. Effect of longer-term modest salt reduction on blood pressure. Cochrane Database Syst Rev 2004;3: CD004937.
4. Sacks F, Svetkey L, Vollmer W, et al. Effects on blood pressure of reduced dietary sodium and the dietary approaches to stop hypertension (DASH) diet. N Engl J Med 2001;344:3–10.
5. Hooper L, Bartlett C, Davey SG, et al. Advice to reduce dietary salt for prevention of cardiovascular disease. Cochrane Database Syst Rev 2004;1:CD003656.
6. He FJ, Macgregor GA. A comprehensive review on salt and health and current experience of worldwide salt reduction programmes. J Hum Hypertens 2008;23:363–84.
7. Neuman W. Citing hazard, New York says hold the salt. New York Times. 10 Jan 2010.
8. Appel L, Anderson C. Compelling evidence for public health action to reduce salt intake. N Engl J Med 2010;362:650–2.
9. Danaei G, Ding EL, Mozaffarian D, et al. The preventable causes of death in the United States: comparative risk assessment of dietary, lifestyle, and metabolic risk factors. PLoS Med 2009;6(4):e1000058.
10. Palar K, Sturm R. Potential societal savings from reduced sodium consumption in the U.S. adult population. Am J Health Promot 2009;24:49–57.

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