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Will Reducing Dietary Salt Lower the Risk of Cardiovascular Disease?

Too often proponents of reducing a population's average sodium intake level want to skip ahead and focus on the challenges of implementing such a program. They ask: can food technologists develop low-sodium foods that are both safe and palatable? And, if so, will this result in consumers choosing a diet that reduces today's "normal" sodium intake average of about 3,500 mg/day to 2,300 mg/day or even 1,500 mg/day?

Not so fast

While implementation presents an immense challenge, a focus on implementing salt reduction ignores the basic question: why do it at all? What evidence do we have that reducing dietary sodium will lower the risk of heart attacks and strokes as forecast? One public health group charged that reducing dietary sodium would prevent 150,000 deaths in the U.S. alone.[1] Could it be true that the amount of salt in our diet kills nearly four times as many as die on the nation's highways? And this question is even more important abroad: many populations around the world consume far more salt than do Americans. So the crucial question is: are the basic assumptions underlying a broad recommendation to the general population to reduce their salt based on fact or fable?

A quarter century ago, the perceived consensus view linked the long-known association of salt and blood pressure with the documented lower incidence of heart attacks and strokes in populations with lower blood pressures. Those observations are even better understood today. More significantly, however, we also understand today that blood pressure is but one of several important predictors of cardiovascular events. Blood pressure, like insulin resistance, sympathetic nervous system activity and plasma renin activity are all intermediate variables that contribute to the all-important health outcome of cardiovascular health. In fact, elevated blood pressure is not a disease or medical condition, but a response of the body indicating a problem someplace in our body's normal regulation of its physiology. We've been focused on the symptom, not the real problem.

Consensus on health outcomes

A strong consensus has emerged that health outcomes are the appropriate metric and that how we lower blood pressure makes a difference.[2] Lowering blood pressure generally is good, but that benefit can be lost if the means employed raises another health risk. Only a couple centuries ago, bloodletting was acceptable medicine. It certainly lowers blood pressure, but is, today, an unacceptable medical treatment. Health outcomes are what is important. Dr. Jeffrey R. Cutler of the National Heart, Lung and Blood Institute said of a health outcomes trial of various antihypertensive drugs: "Trials are based on the notion that different antihypertensive regimes, despite similar efficacy in lowering blood pressure, have other beneficial or harmful effects that modify their net effect on cardiovascular or all-cause morbidity and mortality."[3]

While this major trial of various drug therapies has been completed, no trials of lifestyle interventions have been undertaken to determine the safety and efficacy of interventions like salt restriction in improving cardiovascular outcomes or all-cause mortality. Only a limited number of observational studies have been reported on the question of whether those on low-salt diets have achieved the long-predicted lowering of heart attack incidence.

Outcomes studies results

It turns out that these few studies show that salt restriction does not improve health outcomes at all. Of only a dozen reported health outcomes studies,[4] only one found evidence of any benefit at all – and that in an exceptionally-high salt-consuming Japanese population where the "low-salt" group consumed far more salt than the average American.[5] The other 11 studies failed to find any reduced incidence of heart attacks and strokes in the populations they studied. Three, in fact, found increased risks for those consuming reduced-salt diets,[6] just the opposite of the confident predictions of authorities since the 1970s. On that basis, there would not even be enough evidence to warrant a controlled trial to determine if reducing dietary salt is a good idea – except that the recommendation is already enshrined as public policy. The evidence, thus, clearly indicates the need for a controlled trial to finally determine if the appropriate policy was put in place decades ago. Such a trial is long overdue!

continued on page 2

It was only a decade ago when the possibility that more harm than good was resulting from our national policy captured public headlines. Dr. Michael H. Alderman, current chairman of the Scientific Council and president of the International Society of Hypertension, reported in the American Heart Association's journal *Hypertension* that those of his hypertensive patients on low-salt diets had a four-fold greater incidence of heart attacks than those on normal diets.[7] (graph 1).

Admittedly, this was just one study and for a special population (although usually thought to be the population that would benefit most from salt restriction) but it was funded by our government and findings never disputed by counter evidence.. Within a very few years, analyses of national population databases in Scotland and the United States confirmed Dr. Alderman's fear, that low-sodium diets are associated with higher, not lower, rates of all-cause mortality. The Scottish Heart Health Study found low-salt-consuming Scots dying at a rate nearly a third higher than their highest-salt-consuming countrymen; the study appeared in the *British Medical Journal*.[8] In the U.S., Dr. Alderman examined the federal government's National Health and Nutrition Examination Survey (NHANES I) and found a 20% greater fatality rate among those on low-sodium diets; this in a 1998 article in *The Lancet*.[9] (graph 2 and 3).

Government scientists expressed doubts and did their own analyses, using another major database, the MRFIT study. In two studies of all-cause mortality at 6 years and heart attack deaths at 14 years, Drs. Cutler[10] and Jerome D. Cohen[11] confirmed that there is no population benefit of reducing dietary salt. (graph 4 and 5). Perhaps because their results didn't track government policy preferences, neither published their results.

Proponents of universal salt reduction have touted two studies showing that overweight men have salt-associated health outcomes risks. A Finnish study showed those individuals in the lowest quartile of salt in their diets had less coronary heart disease and fewer cardiovascular or all-cause deaths, though no benefit regarding stroke.[12] A U.S. study of the NHANES I database found no relationship with coronary heart disease, but lower risk, as in the Finnish study, for cardiovascular and all-cause mortality, and for stroke incidence.[13] Those who were not overweight derived no benefit by reduced salt intakes. Neither study documented improved health outcomes for the overall population. It is worth noting that Americans ingest only average amounts of sodium, about 150 mmol (3,450 mg)/day. What is particularly noteworthy in the Finnish study is that the lowest quartile took in 159 mmol (3,657 mg) while in the Japanese study the low-sodium third took in 177 mmol (4,070 mg) Thus these studies were reporting on isolated segments of populations whose upper level of salt intake bore no relationship to that typically consumed in the U.S. For the levels of salt ingested in the U.S. there has yet to be a published report documenting an adverse effect.

Before the 2000 issue of the *Dietary Guidelines for Americans*, the advice was to ingest salt in moderation; that advice sounds even better today. Clearly, the new *Guidelines* emphasis on weight control is well-documented.

Chart 1

Risk in Hypertensives

"Low urinary sodium is associated with greater risk of myocardial infarction among treated hypertensive men", Alderman et. al. *Hypertension*, 1955

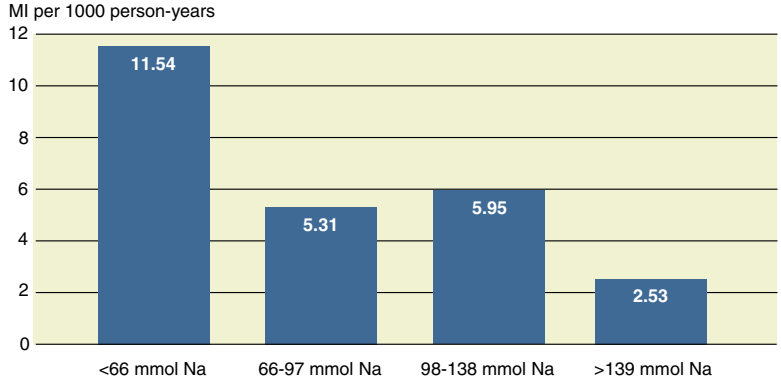


Chart 2

Risk in Scottish Population **Scottish Heart Health Study-10 year Follow-up**

Tunstall-Pedoe, "Comparison by prediction of 27 different factors of coronary heart disease and health in men and women of the Scottish heart heart health study: cohort study." 315 *BMJ* 722-729 (1997). Table 6: age adjusted hazard ratios for men

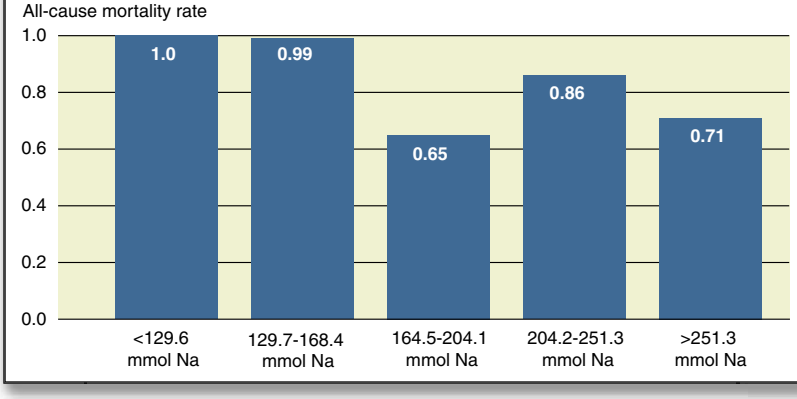


Chart 3

General Population Risk
NHANES I 20-year follow-up
Alderman, *The Lancet*, March 14, 1998

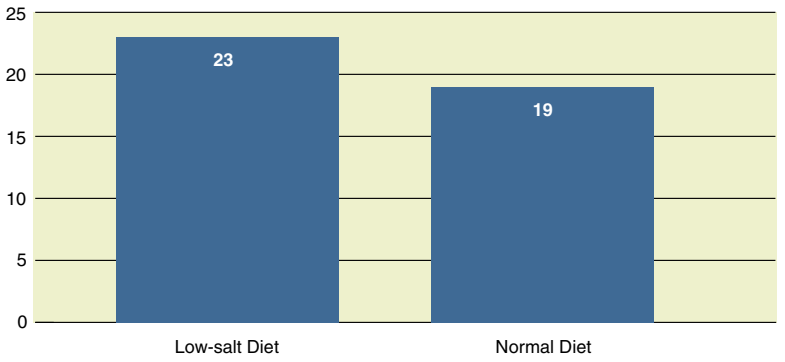


Chart 4

General Population Risk
MRFIT 6-year follow-up
Cutler, presented May 30, 1997 at American Society of Hypertension

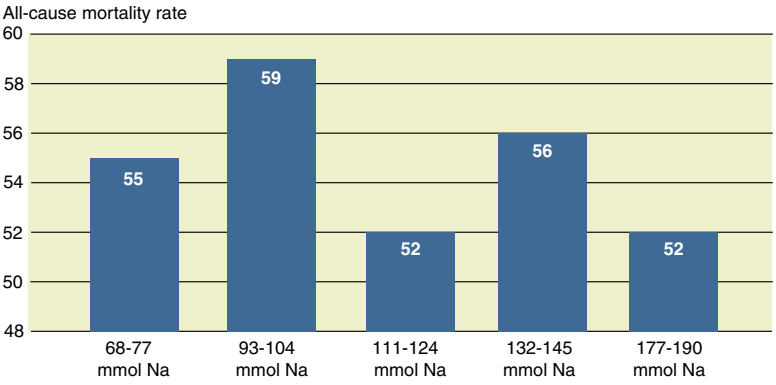
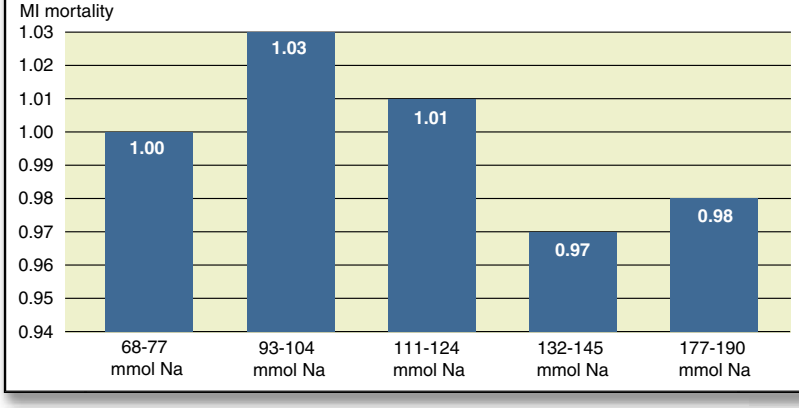


Chart 5

General Population Risk
MRFIT 14-year follow-up
Jerome D. Cohen, presented January 28, 1999 at NHLBI workshop on sodium & blood pressure



Multiple variables

If low-salt diets can reduce overall population blood pressure and if lower blood pressure normally results in reducing the incidence of cardiovascular events and mortality, what should we make of the fact that the only health outcomes studies don't support universal salt reduction? Why have the forecast benefits gone missing?

If we had examined another intermediate variable instead of blood pressure – plasma renin activity, for example, though insulin resistance or sympathetic nervous system activity would be the same – we would have found evidence that reducing dietary salt increased the risk of adverse health outcomes.[14] Since the incidence of heart attacks or deaths is the result of the net effect of any intervention, it becomes clear why it has not been possible to show that salt reduction will achieve the benefits postulated years ago: the adverse risks of stimulating plasma renin activity offset any benefit owing to blood pressure impact. It is the net effect that determines health outcomes.

The importance of the renin-angiotensin system in blood pressure has been understood since the 1970s, pioneered by Dr. John Laragh who garnered a cover story in Time magazine in 1975.[15] It wasn't until 1989, when Dr. Alderman published an analysis showing hypertensives with high plasma renin activity had 430% greater incidence of heart attacks, however, that the dots began to be connected. That reducing dietary salt stimulated plasma renin activity was understood. It was becoming clearer why salt restriction was not the unmitigated solution to cardiovascular health.

During the 1990s, meta-analyses became popular as a means to synthesizing and extracting results from clinical trials. A meta-analysis collects all the individual data from studies pre-determined to satisfy certain methodological standards, lumps those data together and analyzes them as if they were a single study, thus gaining the statistical power of a larger universe. Meta-analysis is one tool employed by practitioners of evidence-based

continued on page 4

medicine (EBM). Pioneered by the Cochrane Collaboration,[16] EBM is the application of strict criteria to the quality and validity of scientific research, substituting pre-determined quality-of-science rules for the less-valid statements of expert opinion often used to guide health policy-making. The U.S. Preventive Services Task Force at the Department of Health and Human Services[17] is the in-government champion of EBM.

Several analyses considered the blood pressure impacts of salt reduction. In 2002, however, the Cochrane Collaboration released its "Systematic review of long term effects of advice to reduce dietary salt in adults." It concluded: "It is unclear what effects a low sodium diet has on cardiovascular events and mortality. Lowering sodium intake may have adverse effects…."[18] And the U.S. Preventive Services Task Force weighed-in: "There is insufficient evidence that, for the general population, reducing dietary sodium intake or increasing dietary intake of iron, beta-carotine or other antioxidants results in improved health outcomes."[19]

"Political" science

This isn't the way the story is usually portrayed in the media. And government "expert" groups toe the line endorsing universal sodium reduction. You've heard the fable; now you have the facts.

And you're not alone. Back in 1998, investigative reporter Gary Taubes won the National Association of Science Writers prize for his story "The (Political) Science of Salt." Taubes concluded: "After interviews with some 80 researchers, clinicians, and administrators around the world, it is safe to say that if ever there were a controversy over the interpretation of scientific data, this is it….After decades of intensive research, the apparent benefits of avoiding salt have only diminished. This suggests either that the true benefit has now been revealed and is indeed small or that it is non-existent and researchers believing they have detected such benefits have been deluded by the confounding of other variables."[20]

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Salt Institute

700 North Fairfax Street
Fairfax Plaza, Suite 600
Alexandria, VA 22314-2040

Voice	:	**703 / 549-4648**
Fax	:	**703 / 548-2194 Fax**
Web Site	:	**http://www.saltinstitute.org**
e-mail	:	**info@saltinstitute.org**

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