

# Salt

The  
Forgotten  
Killer



*...and FDA's Failure to  
Protect the Public's Health*

Center for Science in the Public Interest



# **Salt**

## **The Forgotten Killer**

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The Center for Science in the Public Interest (CSPI), founded in 1971, is a nonprofit health-advocacy organization. CSPI conducts innovative research and advocacy programs in the areas of nutrition, food safety, and alcoholic beverages and provides consumers with current information about their own health and well-being. CSPI is supported by almost one million subscribers in the United States and Canada to its *Nutrition Action Healthletter* and by foundation grants.

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## EXECUTIVE SUMMARY:

A diet high in salt (sodium chloride) is a major cause of heart disease and stroke. Despite pleas from government and other health experts over the last quarter-century to reduce salt consumption, Americans are consuming more—not less—salt.

### High blood pressure (hypertension) and cardiovascular disease

- ★ Increased blood pressure causes an estimated two-thirds of strokes and almost half of all heart attacks around the world.
- ★ About 65 million American adults have high blood pressure. An additional 45 million people have “pre-hypertension.” About 90 percent of Americans will eventually develop hypertension.
- ★ African Americans’ rate of hypertension is 60 percent greater, and rate of stroke deaths 40 percent greater, than that of the general population.
- ★ Americans now spend over \$15 billion a year on medications to lower blood pressure.

### The link to salt consumption

- ★ Consuming more salt tends to increase blood pressure and the risk of cardiovascular disease.
- ★ Sodium intake—mostly from salt—has drifted upwards over the past 30 years and now averages about 4,000 milligrams per day, about twice the recommended amount.
- ★ The vast majority—about 77 percent—of sodium comes from processed foods and foods eaten outside the home. The foods that provide the most sodium to the average diet—because they are frequently consumed and/or rich in sodium—are bread, cheese, ham, salad dressings, and cakes and cookies.
- ★ Many restaurant meals provide more than a whole day’s worth of sodium. Thousands of packaged foods provide one-fourth or more of a day’s maximum recommended intake.
- ★ One survey found that between 1994 and 2004 the average sodium content of foods increased by 6 percent.

# FACTS ON SALT AND CARDIOVASCULAR DISEASE

- ★ The World Health Organization, National Academy of Sciences, U.S. Department of Agriculture, and U.S. Department of Health and Human Services have encouraged people to consume less sodium and industry to reduce sodium levels in their foods. Many health and medical organizations have advocated a 50 percent reduction in sodium in processed and restaurant foods over the next 10 years.
- ★ The U.S. Food and Drug Administration and the Department of Agriculture have done little to reduce sodium consumption. Not one Food and Drug Administration employee is charged with developing measures to lower sodium consumption.

## The bottom line

- ★ Reducing sodium consumption by half would save an estimated 150,000 lives per year. That in turn would reduce medical care and other costs by roughly \$1.5 trillion over 20 years.

## Recommendations

- ★ Consumers should choose less-salty foods.
- ★ Food manufacturers and restaurants should use as little salt as possible in their products.
- ★ Government should:
  - change salt's regulatory status from "Generally Recognized As Safe" to "food additive" and set limits on the salt content of foods that provide the most salt to the average diet
  - encourage food manufacturers and restaurants to use less salt
  - require chain restaurants to disclose on menus and in brochures the sodium content of their foods
  - improve labeling of packaged foods to highlight those that are high in salt



## Salt Reduction: A Vital Objective

Salt. The pure white crystals that glisten in shakers on dining tables across the land look as innocent as newly fallen snow. But appearances can be deceiving. That humble seasoning, so ubiquitous in the American diet, is a major cause of high blood pressure (hypertension), a condition that causes heart attacks and strokes. The threat is particularly grave for African Americans, whose rate of hypertension is 60 percent greater, and rate of stroke deaths is 40 percent greater, than that of the general population.<sup>1</sup>

Doctors first suspected 100 years ago that salt (sodium chloride) increases blood pressure. Epidemiologists found that populations, such as in northern Japan, that consume high levels of sodium (almost all from salt) suffer high rates of hypertension, while populations with low sodium intakes (hunter-gatherer tribes) have low rates. More than 50 years ago, studies done on laboratory animals showed that saltier diets raise blood pressure. And, over 30 years ago, controlled studies in humans first showed that decreasing sodium intake could reduce blood pressure. Researchers also noted that in people living in industrialized nations—but not in tribes eating low-sodium diets—blood pressure tended to rise with age. As Louis Tobian, Jr., who headed the hypertension unit at the University of Minnesota School of Medicine, told a congressional committee, “One must realize that prehistoric man for 3 million years was on a low-salt diet. ...We were never intended to have access to so much salt.”<sup>2</sup>

Subsequent research has quantified not just the effects of salt on blood pressure but also the health and economic benefits of lower-sodium diets. Increased blood pressure causes an estimated two-thirds of strokes and almost half of all heart attacks around the world.<sup>3</sup>

For years, health experts, including those at the National Academy of Sciences, U.S. Department of Agriculture (USDA), and U.S. Department of Health and Human Services (HHS), have been encouraging people to consume less sodium—and industry to reduce sodium levels in the foods they produce—to reduce blood pressure and the consequent risks of stroke and heart disease, as well as kidney damage. Consuming less sodium is one of the single most important ways to prevent cardiovascular disease. A decade ago, the National High Blood Pressure Education Program, a unit of the National Heart, Lung, and Blood Institute

“Reduction in the amount of salt added by manufacturers to processed food is a vital public health objective. ...Few measures in preventive medicine are as simple and economical and yet can achieve so much.”

— M.R. LAW, C.D. FROST, AND N.J. WALD<sup>1</sup>

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Consuming less sodium is one of the single most important ways to prevent cardiovascular disease.

(NHLBI, part of the National Institutes of Health), concluded that “...observational and experimental studies provide compelling evidence of the value of reducing sodium intake in the primary prevention of hypertension.”<sup>4</sup>

Despite such clear expressions of concern by top health and policy experts, the battle against high blood pressure is being lost. Sodium consumption has been rising, not falling. The percentage of Americans with high blood pressure has been increasing. Government agencies have done little to take preventive actions to prevent that killer health condition. New efforts—educational and regulatory—are clearly needed to protect the public’s health.

## Sodium Intake on the Rise

Health experts from the Surgeon General on down have decried diets high in sodium. But they have never taken strong policy actions or mounted compelling educational programs to correct the problem. The result? Sodium consumption has been steadily increasing.

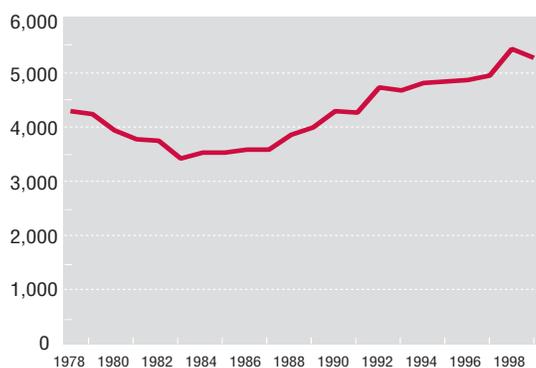
Data on the production of food-grade salt provide one rough measure of trends in salt consumption. According to the Salt Institute, per capita production declined significantly for several years beginning in 1978, but then increased steadily to 1998 (figure 1).<sup>5</sup>

The usual way to assess how much sodium people consume is by conducting dietary-recall surveys, such as HHS’s National Health and Nutrition Examination Survey (NHANES) and USDA’s Continuing Study of Food Intakes by Individuals (CSFII). The findings of both surveys are deeply troubling because they demonstrate that consumption has risen over the years and is substantially higher than recommended (figure 2).

Sodium intake has drifted steadily upwards, increasing from about 2,300 milligrams (mg) per day in the early 1970s to about 3,300 mg in 1999–2000. In 1994–96, low-income men 20 years and older consumed the highest levels of sodium, with an average intake of 4,260 mg per day.<sup>6</sup> (It is

unclear to what extent changes over the years in survey methodology influenced sodium measurements.)

**Figure 1**  
U.S. per capita production of food-grade salt (milligrams/day)



**Note:** Per capita production is inferred from U.S. salt sales as reported by the Salt Institute; population data are from the U.S. Census Bureau.

To put those dietary-recall numbers in context, consider that health experts recommend that Americans consume between 1,500 and 2,400 mg of sodium per day. (See box on “Daily Sodium Recommendations for Americans” on p. 20.) That is equivalent to between two-thirds and one teaspoon of salt. The Institute of Medicine recently reported that the body normally needs only about 180 mg per day to replace the sodium lost in urine, sweat, and feces,<sup>7</sup> and the Yanomami Indians in Brazil and Venezuela consume only about 20 mg per day.<sup>8</sup> Those Indians are healthy, do not gain weight as they age, and are totally free of high blood pressure.

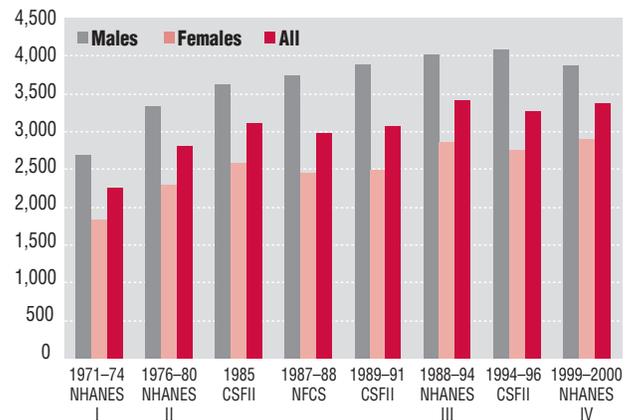
Sodium consumption is actually considerably higher than what dietary-recall surveys find. That is partly because people do not accurately remember or report what they eat and partly because the surveys do not measure how much salt people add at the table. Actual consumption is estimated at about 15 percent more than the levels indicated by dietary surveys, or about 4,000 mg per day.<sup>9</sup> (See box at right.)

Two factors led to increased sodium intake. In the 1970s and 1980s, the ratio of sodium to calories increased sharply, indicating that people were consuming foods and restaurant meals that tended to be higher in sodium (figure 3, next page). Since 1987–88, sodium intake has continued to increase, but the ratio of sodium to calories has remained fairly constant. That indicates that the recent rise in sodium intake was due to increased food (calorie) consumption, rather than to saltier foods.

## Where Are We Getting All That Sodium?

When most people think of salt and sodium, they probably think of the salt shaker, but that actually provides very little of our salt. According to some estimates, only about 6 percent is added while eating and 5 percent during cooking.<sup>10,11</sup> Another 12 percent of the sodium occurs naturally—dairy products are a significant source—and a little comes from tap water.

**Figure 2**  
Americans' average sodium consumption (mg/day), based on dietary-recall surveys



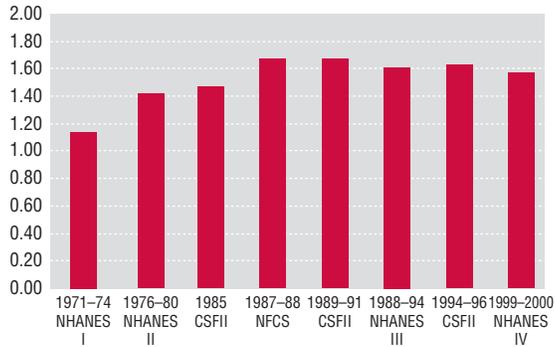
**Notes:** Data do not include salt added at the table. Population age varied by survey: NHANES I, 1–74 years; NHANES II, 6 months–74 years; NHANES III and IV, all ages; CSFII 1985, 19–50 years; all remaining USDA surveys (NFCS, CSFII), 20+ years.

### The Best Way to Measure Sodium Intake

The most accurate way to assess sodium intake is to measure how much sodium is excreted in urine. That approach is expensive, so sample sizes are relatively small and not representative of the entire population. Several studies found sodium intakes of 4,000 mg per day (averaging men and women).<sup>ii</sup> Furthermore, because about 5 to 10 percent of sodium is excreted in sweat and feces, even measuring the amount of sodium in urine slightly underestimates actual sodium intake.<sup>iii</sup>

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**Figure 3**  
Sodium/calorie ratios, based on dietary-recall surveys (average of males and females)



Note: Ratios are mg sodium divided by calorie intake and reflect the “sodium density” of the American diet. See text.

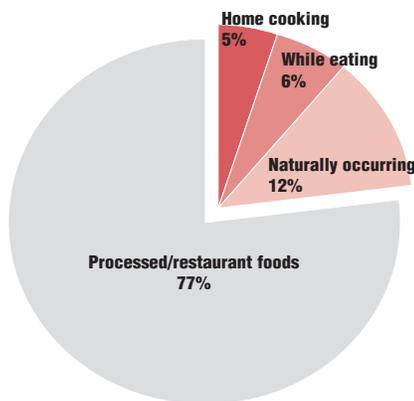
The vast majority—about 77 percent—comes from processed foods and foods eaten outside the home (figure 4): food sources whose very nature makes it nearly impossible for the consumer to control the sodium content. The foods that provide the most sodium—because they are frequently consumed and/or rich in sodium—to the average American diet are bread, cheese, ham, salad dressings, and cakes and cookies (figure 5).<sup>12</sup>

### The Key Culprits

Though numerous ingredients and additives contribute sodium to the diet, far and away the biggest contributor is ordinary salt. In most foods, salt serves as a flavoring. After all, it is tasty and a lot cheaper than vegetables, meat, herbs, spices, or other natural ingredients. But salt serves many other functions. In some foods (like ham), it helps prevent bacterial growth; in others (like sausage), it helps confer the desired texture. Salt also may be used to mask “off-flavors” that develop during high-temperature processing and long storage.

Adding more sodium to the diet are numerous food additives, including monosodium glutamate, sodium propionate, sodium bicarbonate (baking soda), and sodium stearoyl lactylate. However, sources of sodium other than sodium chloride may have a lesser, or no, effect on blood pressure.<sup>13,14</sup>

**Figure 4**  
Sources of sodium



Source: Mattes and Donnelly (see note 11).

Many processed foods contain shockingly high levels of sodium (table 1, p. 6). Several Swanson Hungry Man frozen dinners contain more than 3,000 mg of sodium—that’s more than a teaspoon of salt and far more than a person should eat in an entire day. Many other products provide more than half-a-day’s worth of salt. A one-cup serving of Bush’s Best Homestyle Chili Original (no beans) contains 1,380 mg of sodium. A package of Maruchan Instant Lunch Ramen Noodles with Vegetables provides 1,410 mg of sodium, and a Banquet Homestyle Bakes Country Chicken meal provides 1,350 mg.

Thousands of foods contain 500 to 1,000 mg per serving.

Furthermore, the sodium levels indicated on labels may grossly underestimate the actual amount consumed, because people may eat portions two or three times as large as the serving size indicated. Most packages of ramen noodle soups, for example, contain two servings, but many people eat the entire contents of the package.

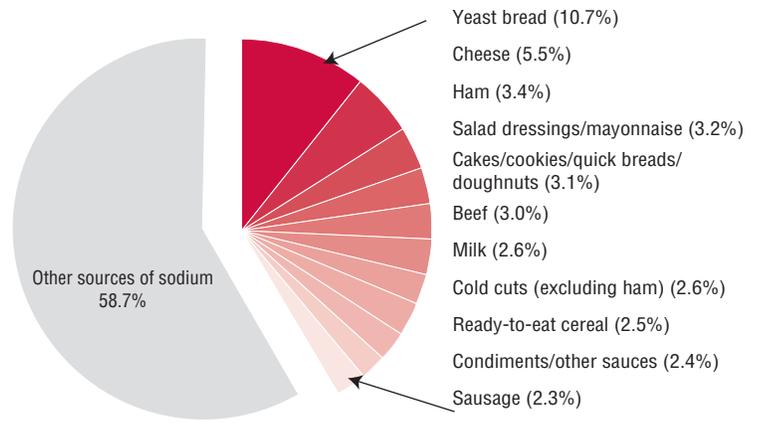
Foods eaten outside the home provide Americans with about one-third of all calories and probably about the same proportion of their sodium.<sup>15</sup> Restaurant companies' literature and tests by the Center for Science in the Public Interest (CSPI) demonstrate that many restaurant foods and meals contain astronomical levels of sodium (table 2, p. 7).<sup>16</sup> For instance, an average order of spaghetti with sausage contains 2,440 mg of sodium, a typical Reuben sandwich 3,270 mg, house lo mein at a Chinese restaurant roughly 3,460 mg, and cheese fries with ranch dressing almost 5,000 mg. Each of those items is higher than the Daily Value of 2,400 mg listed on food labels and far higher than the Acceptable Intake of 1,500 mg set by the Institute of Medicine. At McDonald's, a medium order of French fries—often thought of as a salty food—contains 220 mg of sodium. A small burger (530 mg), Filet-O-Fish (640), Big Mac (1,010), and six Chicken McNuggets (670 mg) contain far more. Unfortunately, the 1990 law that requires Nutrition Facts labels on packaged foods specifically exempts restaurants—so eating out is basically a nutritional crap shoot.

## Industry Attempts at Reduction

In 1983, CSPI began monitoring the sodium content of 100 brand-name products, with the mix generally representing the degree to which different categories contribute to overall sodium intake. Of the 69 products still marketed in 2004, the average sodium content decreased by just 5 percent, or 0.3 percent per year.<sup>17</sup> While the sodium content of a hot cereal declined by 71 percent, the sodium content of a frozen dinner increased by 82 percent. And a brand of canned tuna and a variety of canned soup did not change by even 1 mg over the two decades. More disturbing, between 1994 and 2004, the average sodium content actually increased by 6 percent.

Some companies have introduced new “light,” “low,” or “reduced sodium” products over the years, providing consumers with new options. ConAgra deserves special recognition for its wide-ranging line of Healthy Choice reduced-sodium products, which were first marketed nationally in 1989. Healthy Choice pasta sauces, deli meats, frozen meals, and other

**Figure 5**  
Sodium-rich foods (as % of total dietary sodium)



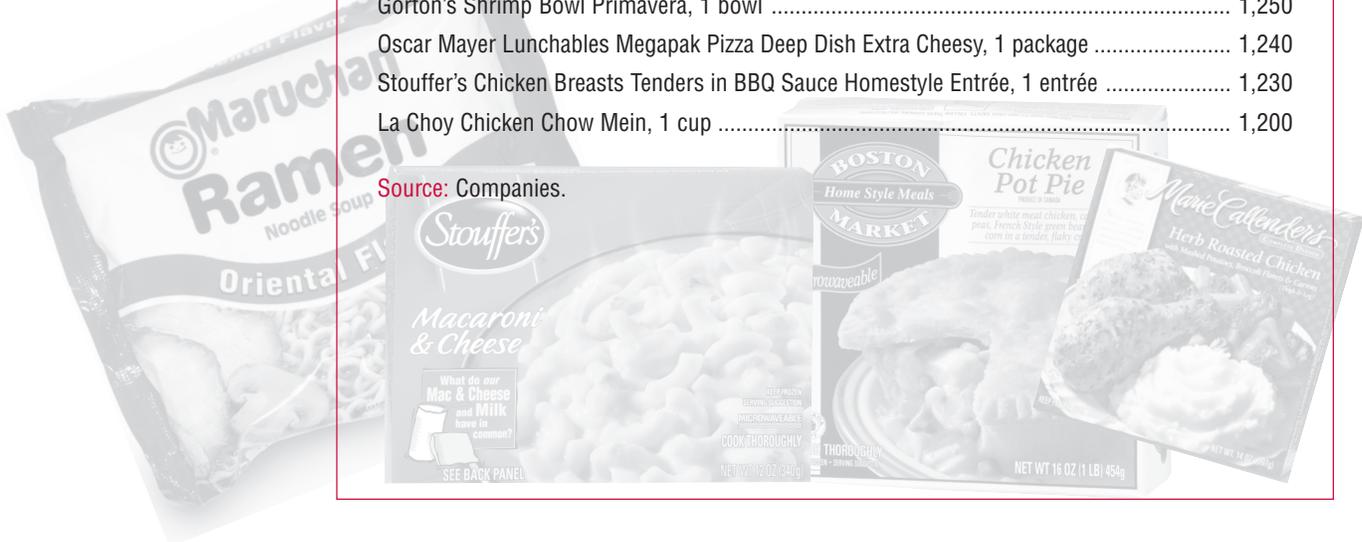
Source: Cotton, Subar, Friday, et al. (see note 12).

## HIGH-SODIUM PACKAGED FOODS...

**Table 1**  
Packaged foods high in sodium

Food, serving size	Sodium (mg)
Swanson's Hungry Man XXL Roasted Carved Turkey, 1 package	5,410
Swanson's Hungry Man XXL Angus Beef Meatloaf, 1 package	3,480
Swanson's Hungry Man XXL Southern Fried Boneless Chicken, 1 package	3,180
Boston Market Homestyle Meal Beef Sirloin w/ Noodles, 1 package	2,270
Marie Callender's Classic One Dish Chicken Teriyaki, 1 package	2,200
Mott's Mr and Mrs T. Bloody Mary Mix, 12 oz	2,100
Oscar Mayer Lunchables Deluxe Turkey & Ham w/ Swiss & Cheddar, 1 package	1,940
Gorton's Shrimp Bowl Fried Rice, 1 bowl	1,700
Stouffer's Beef Pot Roast w/ Roasted Potatoes Homestyle Dinner, 1 dinner	1,610
Marie Callender's Meat Loaf & Gravy Complete Dinner, 1 dinner	1,510
Stouffer's Slow Roasted Beef and Gravy Homestyle Dinner, 1 dinner	1,510
Banquet Macaroni & Cheese Dinner, 1 dinner	1,500
Uncle Ben's Teriyaki Chicken Rice Bowl, 1 bowl	1,450
Maruchan Instant Lunch Ramen Noodles w/ Vegetables, 1 package	1,410
Mrs. Paul's Garlic Butter Shrimp Bowl, 1 bowl	1,390
Bush's Best Homestyle Chili Original No Beans, 1 cup	1,380
Uncle Ben's Teriyaki Stir Fry Vegetable Rice Bowl, 1 bowl	1,350
Banquet Homestyle Bakes Complete Meal, Country Chicken, 1 meal	1,350
Freschetta Pepperoni Pizza, ½ pizza	1,350
Mrs. Paul's Shrimp Stirfry Bowl, 1 bowl	1,300
Stouffer's Chunky Beef & Bean Chili Entrée, 1 entrée	1,300
Campbell's Soup Cheddar Cheese, 10% oz. prepared	1,280
La Choy Soy Sauce, 1 tablespoon	1,260
Oscar Mayer Lunchables Megapak Deep Dish Pepperoni, 1 package	1,250
Gorton's Shrimp Bowl Primavera, 1 bowl	1,250
Oscar Mayer Lunchables Megapak Pizza Deep Dish Extra Cheesy, 1 package	1,240
Stouffer's Chicken Breasts Tenders in BBQ Sauce Homestyle Entrée, 1 entrée	1,230
La Choy Chicken Chow Mein, 1 cup	1,200

Source: Companies.

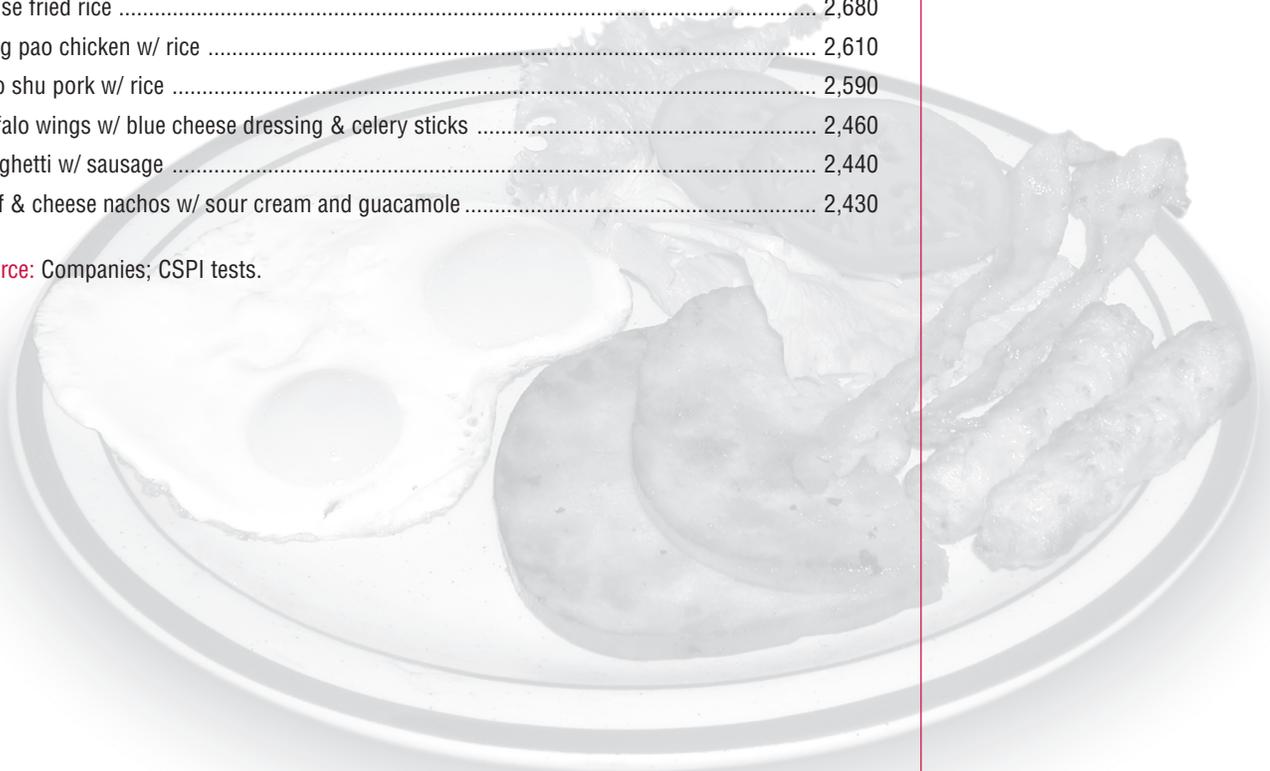


## ...AND RESTAURANT FOODS

**Table 2**  
**Restaurant foods high in sodium**

Item	Sodium (mg)
Cheese Fries w/ ranch dressing .....	4,890
Schlotzky's Large Original sandwich .....	4,590
Dunkin' Donuts Salt Bagel .....	4,520
Denny's Lumberjack Slam (two eggs, three hotcakes w/ margarine & syrup, ham, two strips of bacon, & two sausage links) .....	4,460
Fried whole onion w/ dipping sauce .....	3,840
House lo mein .....	3,460
Denny's Meat Lover's Breakfast (two eggs, bacon, two sausages, hash brown potatoes, & toast) .....	3,460
Reuben sandwich .....	3,270
Beef with broccoli w/ rice .....	3,150
General Tso's chicken w/ rice .....	3,150
Orange (crispy) beef w/ rice .....	3,140
Overstuffed corned beef sandwich w/ mustard .....	3,130
Shrimp w/ garlic sauce w/ rice .....	2,950
Denny's Moons Over My Hammy (ham & egg sandwich w/ Swiss & American cheese on sourdough) .....	2,700
House fried rice .....	2,680
Kung pao chicken w/ rice .....	2,610
Moo shu pork w/ rice .....	2,590
Buffalo wings w/ blue cheese dressing & celery sticks .....	2,460
Spaghetti w/ sausage .....	2,440
Beef & cheese nachos w/ sour cream and guacamole .....	2,430

Source: Companies; CSPI tests.



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products all meet the U.S. Food and Drug Administration’s (FDA’s) criteria for use of the term “healthy” on the label—no more than 480 mg of sodium per serving for individual foods and 600 mg for “meal-type” foods. Healthy Choice foods typically contain half or less of the sodium content of many competing products.

In the early 1980s, several companies—including McDonald’s, Quaker, and Campbell—made public commitments to reduce sodium levels. Their success can be gauged by comparing the sodium content of products made by those companies in 1984 and in 2004. After adjusting for changes in serving size, the sodium content of 16 McDonald’s products (including Egg McMuffin and Filet-O-Fish) declined by an average of 9 percent, eight Quaker products (including instant oatmeals and Aunt Jemima pancake mixes) declined by an average of

23 percent, and 13 Campbell soups declined by an average of 10 percent. It is gratifying that at least some companies have reduced sodium, but those reductions have been modest—averaging half a percent to 1 percent per year.

Sodium levels vary widely across brands (table 3). Some brands have 50 to 200 percent more sodium than their competitors. For instance, Sunbeam Thin white bread has 420 mg of sodium per 100 grams (g), while Wonder Thin has 540 mg (30 percent more) and Pepperidge Farm Farmhouse Hearty White has 650 mg (over 50 percent more). Wellshire Farms Old Fashioned Premium Franks has 540 mg per 100 g, while Oscar Mayer XXL Deli Style Beef Franks, with 1,100 mg per 100 g, provides twice as much sodium.

Too, the “same” product marketed in different countries may have different sodium levels (after equalizing serving sizes). In the United States, Nabisco’s Wheat Thins, with 260 mg per ounce, has almost twice as much sodium as the Canadian version, marketed under the Christie brand. The U.S. version of Nabisco’s Premium Saltines has 40 percent more sodium per serving than its Canadian counterpart. And, while Kraft has lowered the sodium content of its popular Lunchables meals by 30 percent in the United Kingdom, it has not done so in the United States.<sup>18</sup>

One thing that is *not* responsible for increased salt consumption is the salt shaker. Between 1972 and 1985, consumers purchased about 36 percent less salt.<sup>19</sup> While more recent data are not available, in the United

## COMPARISONS OF SODIUM IN PACKAGED FOOD

**Table 3**  
**Sodium content of packaged foods: brand-to-brand comparisons**

Food	Serving size (g)	Sodium (mg)	Mg sodium/100g
<b>American Cheese</b>			
Kraft American Singles	21	270	1,285
Borden American Singles	19	260	1,368
Giant Deluxe American Singles	19	330	1,737
<b>Hot Dogs</b>			
Wellshire Farms Old Fashioned Premium Franks	84	450	536
Hebrew National Beef Franks	49	370	755
Oscar Mayer XXL Deli Style Beef Franks	76	740	974
Ball Park Fat Free Beef Franks	50	490	980
Gwaltney Great Dogs 40% Less Fat	56	760	1,360
<b>Sliced Ham</b>			
Healthy Choice Honey Ham	52	450	865
Oscar Mayer Honey Ham	63	786	1,248
Tyson 97% Fat Free Honey Ham	51	760	1,490
<b>White Bread</b>			
Sunbeam Thin	41	170	415
Wonder Thin	41	220	537
Arnold Country Classics White	38	210	552
Pepperidge Farm Farmhouse Hearty White	43	280	650
<b>Caesar Salad Dressings</b>			
Morgan's Caesar	30	170	566
Old Family Recipe Caesar Light	30	230	766
Wish-Bone Just 2 Good Caesar	30	300	1,000
Ken's Caesar Lite	30	600	2,000
<b>Soups (canned, as prepared)</b>			
Healthy Choice Garden Vegetable	246	480	195
Campbell's Healthy Request Vegetable	240	480	200
Campbell's Vegetarian Vegetable	240	790	329
Progresso Vegetable	238	940	395
<b>Pasta Sauces</b>			
Enrico's All Natural No-salt-added	125	25	20
Classico Tomato and Basil	125	310	248
Ragu Tomato and Basil Light	125	360	288
Healthy Choice Traditional	126	370	294
Prego Traditional	125	580	464
Ragu Traditional Old World Style	125	756	605

**Source:** Companies.

### Replacing the Salt Shaker

There are several ways to replace salt without sacrificing flavor. Lemon juice works on some foods, salsa on others. And a shaker filled with a variety of herbs can be a tasty, convenient way to use less salt. Try this combination:

- 1 teaspoon celery seed, ground
- 2½ teaspoons marjoram, crushed
- 2½ teaspoons summer savory, crushed
- 1½ teaspoons thyme, crushed
- 1½ teaspoons dried basil, crushed
- ½ teaspoon black pepper, crushed

If you don't feel like making your own, try these salt substitutes:\*

- Mrs. Dash Seasonings
- Schilling Salt Free Seasonings
- Parsley Patch Seasonings

Or these, which have little or no sodium, but do contain potassium (per ¼ teaspoon):

- Morton's Salt Substitute: 610 mg potassium/0 mg sodium
- No Salt: 650 mg potassium/0 mg sodium
- Cardia Salt Alternative: 180 mg potassium/270 mg sodium
- Morton's Lite Salt: 350 mg potassium/290 mg sodium

\*Courtesy of Palo Alto Medical Foundation. For more on salt substitutes, see [www.pamf.org/heartfailure/sodium/seasoning\\_subs.html](http://www.pamf.org/heartfailure/sodium/seasoning_subs.html).



Kingdom, household use of salt declined by more than two-thirds between 1960 to 2000.<sup>20</sup> With people cooking less in both the United States and United Kingdom, a similar decline probably occurred in the United States.

In the summary of a 1994 conference on high blood pressure held by the NHLBI, the institute noted that “food industry representatives state that sodium has been silently lowered in food products over the past 20 years.” “However,” the NHLBI added, the data “provide little support for these claims.”<sup>21</sup>

## The Benefits of Reducing Sodium

### Reducing Sodium Reduces Blood Pressure

High blood pressure is epidemic. The 1999–2000 National Health and Nutrition Examination Survey study found that 31.3 percent of Americans have high blood pressure, up from 28.9 percent in 1988–94.

About 65 million adults have high blood pressure, a 30 percent increase over the 50 million in 1988–94.<sup>22</sup> More than half of all Americans 60 and older have high blood pressure.<sup>23</sup> The famed Framingham Heart Study found that about 90 percent of Americans will eventually develop hypertension.<sup>24</sup>

An additional 45 million people have “pre-hypertension,” a category of blood pressure that lies between what is considered normal (if not optimal) and clearly high—specifically, a systolic measure of 120–139 millimeters of mercury (mm Hg) and a diastolic of 80–89 mm Hg.<sup>25</sup> Even that modestly elevated blood pressure can be silently harmful. Claude Lenfant, former NHLBI director, notes that “damage to arteries begins at fairly low blood pressure levels—those formerly considered normal...”<sup>26</sup>

Consuming more sodium tends to increase the retention of fluid carried by blood vessels. That increases both blood pressure and the load on the heart. In addition, the increase in salt and fluid within the circulatory system causes a narrowing of the blood vessels, which further increases pressure and reduces the flow of blood to the tissues. The damage done by a lifetime of high blood pressure may not be undone by treatment.

A large number of studies have been conducted to explore and quantify the link between salt and blood pressure. Early studies in animals found that increasing the salt content of the animals' diets increases blood pressure. Studies conducted over several decades in humans similarly demonstrate that sodium increases blood pressure.

- One large 2004 study conducted in Europe showed convincingly that the higher the sodium intake, the greater the blood pressure and risk of hypertension.<sup>27</sup> The researchers found that people who consume about 5,000 mg of sodium per day have twice the risk of hypertension as those who consume 1,800 mg. They conclude that “even modest...differences in sodium intake are associated with blood pressure differences of clinical and public health relevance.”
- The Dietary Approaches to Stop Hypertension study—DASH—Sodium—was designed to nail down the link between salt and blood pressure. The study, published in 2001, tested the effects on blood pressure of three levels of sodium and two different diets—a typical American diet and a more healthful one.<sup>28</sup> The healthful diet was rich in fruits, vegetables, and grains, and included low-fat dairy foods, lean poultry and meat, fish, beans, and nuts. The “high” sodium level (3,270 mg) contained about one-fifth less sodium than the average American diet. The “intermediate” level (2,460 mg) was one-fourth lower than the high, and the “low” (1,500 mg) level contained about half as much sodium as the high. Participants were given food of known nutrient content to help them adhere to the diet.

The study found significant benefits both from eating a healthy diet (keeping sodium constant) and from eating less sodium. Combining

### Complexities of Studying Salt and Blood Pressure

Research to determine and quantify sodium's effect on blood pressure has been complicated by several factors:

- Studies on rats have shown that individual animals and different strains of animals vary in their sensitivity to sodium. As in animals, individual people may be more or less sensitive to sodium, perhaps because of differences in the responsiveness of enzyme systems to salt.<sup>iv</sup> People with high blood pressure, African Americans, and older people are the most affected by sodium intake.
- Determining a person's exact blood pressure is difficult, because blood pressure varies considerably from day to day and even hour to hour.<sup>v</sup>
- It is difficult to determine subjects' exact sodium intake, which also varies from day to day.

**Hypertension: Starving the Brain**

High blood pressure may impair a person's thinking ability<sup>vi</sup> and even cause dementia.<sup>vii</sup> People with high blood pressure are more likely to perform poorly on tests of learning, memory, and abstract reasoning than those with normal blood pressure. The underlying cause may be that high blood pressure clogs small blood vessels and interferes with blood flow to the brain.

both measures provided a double benefit. For instance, going from the high to the intermediate level of sodium reduced systolic blood pressure by 2.1 mm Hg. Dropping to the low-sodium diet knocked the subjects' blood pressure down another 4.6 mm Hg (total of 6.7 mm Hg). On the other hand, once the subjects were eating a healthy diet, the added benefit of going from high to low sodium was less: 3 mm Hg. Switching from the normal diet to the DASH diet, but keeping sodium at the high level, decreased blood pressure by 5.9 mm Hg. Also, the benefit from a given reduction of sodium increased as total sodium consumption decreased, so the greater the reduction in sodium the subjects achieved, the greater the payoff.

The maximum benefit came from switching from the high-sodium version of the normal diet to the low-sodium version of the DASH diet. That decreased systolic blood pressure by about 8.9 mm Hg. African Americans with hypertension and people over age 45 with hypertension benefited the most from consuming less salt.<sup>29</sup> People under 45 without high blood pressure benefited least (although a large percentage of those people will develop hypertension as they age). It is worth noting that subjects consumed the various diets for only four weeks at a time, and their blood pressure was still declining after four weeks.<sup>30</sup>

“For the general normotensive population, producing persistent reductions in average blood pressure of just a few mm Hg by some widely practicable methods (such as, perhaps, reducing sodium intake in manufactured foods) should avoid large absolute numbers of premature deaths and disabling strokes...”

— PROSPECTIVE STUDIES COLLABORATION<sup>viii</sup>

- Trials of Hypertension Prevention (TOHP II) studied 1,100 moderately overweight, middle-aged adults with moderately elevated blood pressure.<sup>31,32</sup> Half of the participants were intensively counseled to reduce their sodium intake, but were not given low-sodium foods. After three years, the subjects were consuming an average of 24 percent (about 930 mg per day) less sodium than the control group. Their systolic pressure declined 1.7 mm Hg and their diastolic pressure 0.9 mm Hg; moreover, their incidence of hypertension dropped by 18 percent.
- Hypertension experts at NHLBI conducted a major meta-analysis that assessed the combined results of 32 clinical studies.<sup>33</sup> The researchers estimated that a reduction of 2,300 mg of sodium per day would reduce blood pressure by 1.9/1.1 (systolic/diastolic) in people with normal blood pressure and 4.8/2.5 in people with hypertension.
- One important study examined the effects of reducing sodium (with or without a weight-loss effort) in almost 1,000 men and women between the ages of 60 and 80 with elevated blood pressure.<sup>34</sup> The subjects

managed to reduce their sodium intake by about 25 percent. Consequently, their blood pressure dropped by 2.6/1.1 mm Hg compared to the “usual care” (control) group. Combining weight loss with reduced sodium roughly doubled the declines in blood pressure. (One interesting benefit of reducing sodium intake was a reduction in the rate of headaches.)

## Reducing Blood Pressure Reduces Cardiovascular Disease

Scientists, with a few exceptions, agree that lowering sodium intake lowers blood pressure and that lowering blood pressure would save thousands of lives. Indeed, according to a meta-analysis of 61 studies, the lower an individual’s blood pressure—at least down to 115/75—the lower the risk of stroke or heart attack.<sup>35</sup> There was no “threshold” below which the risk did not decrease. Another large study found similar results when diastolic blood pressure ranged between 70 and 110 mm Hg.<sup>36</sup> Thus, while a diastolic blood pressure of 80 is often considered “normal,” it is not optimal. (The Yanomami Indians, mentioned above as being free of hypertension, have a median blood pressure of 95/61.<sup>37</sup>)

Researchers have calculated the potential health benefits from lowering blood pressure. While their estimates vary, they all project major benefits and conclude that even small reductions in blood pressure would yield large benefits. The following examples indicate the magnitude of the likely benefits.

- The meta-analysis of 61 studies mentioned above concluded that a reduction of 10 mm Hg in systolic blood pressure, or 5 mm Hg in diastolic, could result over the long term in about a 40 percent lower risk of stroke death and about a 30 percent lower risk of death from coronary heart disease.<sup>38</sup>
- A group of leading researchers estimates that a modest nationwide 3 mm Hg decrease in systolic blood pressure would result in 11 percent fewer strokes, 7 percent fewer coronary artery disease events, and 5 percent fewer deaths overall.<sup>39</sup> The latter percentage implies about 122,000 fewer deaths per year in the United States.

### Reducing Salt: Cost-Effective Prevention

Framingham Heart Study researchers recommend combining lifestyle changes in the general population with drug treatment of individuals to minimize cardiovascular disease. They calculated that the costs and benefits of intensive community-wide education efforts aimed at lowering blood pressure are competitive with those associated with the usual approach to dealing with hypertension: identifying people who have it and treating them with drugs throughout their lifetime. They noted that the costs of intervention programs could be reduced further if the food industry lowered sodium levels.<sup>ix</sup>

### Hypertension May Begin in Infancy

Research on newborn babies in Holland found that consuming a diet containing one-third the normal amount of sodium over their first six months reduced their systolic blood pressure by 2 mm Hg. In a follow-up study 15 years later, the “low-sodium” babies turned into adolescents whose systolic blood pressure was 3.6 mm Hg lower than the “normal-sodium” babies.<sup>x</sup>

- Researchers using data from the Framingham Heart Study calculated the benefits of a 2 mm Hg decrease in diastolic blood pressure in white 35- to 64-year-old Americans.<sup>40</sup> They found that that decrease was associated with a 17 percent decrease in the prevalence of hypertension, a 15 percent decrease in the risk of stroke and transient ischemic attacks (“mini-strokes”), and a 6 percent reduction in the risk of coronary heart disease.
- In 1993, Jeremiah Stamler, a preeminent cardiovascular epidemiologist at Northwestern University School of Medicine, and his colleagues estimated that lowering the average systolic blood pressure in 35- to 59-year-old men from 130 to 120 mm Hg—admittedly a challenging goal—would reduce mortality by 14 percent and increase life expectancy by 1.5 years.<sup>41</sup> For the middle-aged men they were considering, that reduction would save an estimated 30,000 lives per year. Lowering the average systolic blood pressure down to 110 mm Hg—an enormous challenge—would reduce mortality by an estimated 26 percent and increase life expectancy by three years.
- Two leading British researchers, Feng Jun He and Graham MacGregor, estimate that reducing sodium intake by 1,200 mg per day would reduce stroke deaths by about 13 percent, or 21,000 per year in the United States, and reduce coronary heart disease deaths by almost 10 percent—or 46,800, for a total of 68,000 lives.<sup>42</sup> Halving sodium consumption from about 4,000 to 2,000 mg would save roughly 113,000 lives per year.
- A Finnish study of more than 3,000 25- to 64-year-olds found that a 2,300 mg higher sodium intake was associated with the following increases in death rates: coronary heart disease, 51 percent; total cardiovascular disease, 45 percent; and all-cause mortality, 26 percent.<sup>43</sup> Considering that 650,000 Americans die each year of coronary heart disease and stroke,<sup>44</sup> that study implies that halving daily sodium consumption to 2,000 mg would save over 200,000 lives per year.
- Claude Lenfant, former NHLBI director, Stephen Havas at the University of Maryland School of Medicine, and Edward Roccella, also at NHLBI, estimate that a 50 percent reduction in sodium would “result in at least a 5 mm Hg decrease in systolic blood pressure levels, a 20 percent reduction in the prevalence of hypertension, and 150,000 fewer deaths [per year].”<sup>45</sup> The authors note that the benefits of

reducing sodium might be even greater, because high-sodium diets appear to be harmful in ways other than raising blood pressure (see box at right).

The estimates from the several studies vary somewhat, and the experts will continue to debate the exact number of lives that could be saved by lowering sodium. However, the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure concluded that the relationship of blood pressure to stroke, coronary heart disease, and end-stage renal disease is “strong, continuous, graded, consistent, independent, predictive, and etiologically significant.”<sup>46</sup> Virtually all hypertension experts agree that eating less salt would save tens of thousands of lives each year. Eating an overall more healthful diet and losing weight in addition to lowering sodium levels would save tens of thousands more.

## Reducing Rates of Cardiovascular Disease Saves Money

Preventing cardiovascular disease by lowering sodium intakes would provide not only substantial health benefits, but also substantial economic benefits. Some of those benefits can be quantified using the FDA’s estimates of benefits expected from reducing the consumption of trans fat, another food ingredient that promotes coronary heart disease. In 2003, the FDA, in ruling that trans fat must be listed on food labels, projected that saving 1,276 lives per year would yield benefits over 20 years of \$13.1 billion.<sup>47</sup> By extrapolation, saving an estimated 150,000 lives per year by cutting sodium consumption from 4,000 mg to 2,000 mg per day would provide savings of roughly \$1.5 trillion over 20 years.

Part of the cost savings that could be achieved by lowering blood pressure through a lower-sodium diet would result from reduced use of medicines. Americans now spend over \$15 billion a year on medications to lower blood pressure, according to IMS Health, a health-care information and

### Salt: It’s Not Just Hypertension

Salt may cause health problems not necessarily linked to hypertension, though further research is needed in some cases.<sup>xi</sup>

- Salt increases the body’s excretion of calcium. The evidence is mixed on whether that also leads to loss of bone mass and osteoporosis or other health problems.
- Because it increases calcium excretion, salt may promote the formation of kidney stones.
- High-salt diets impair lung function and worsen asthma symptoms.
- Diets high in sodium appear to cause higher rates of infection with *Helicobacter pylori*, the bacterium that causes stomach ulcers.
- Salt promotes stomach cancer in laboratory animals and is associated with higher rates of stomach cancer in Japan.
- A study of overweight people found that a 2,300 mg higher daily consumption of sodium was associated with an 89 percent increase in stroke mortality and a 44 percent increase in mortality from coronary heart disease.<sup>xii</sup> Those effects were identified *after* controlling for blood pressure and other important variables, suggesting “the possibility of an independent direct effect of sodium intake on cardiovascular disease.”

The FDA has done little to push industry to lower foods' sodium levels, preferring to engage in more passive monitoring activities.

consulting company.<sup>48</sup> Those costs could be cut in half—or even more—if Americans ate lower-sodium foods and more nutrient-rich fruits, vegetables, and other healthful foods; lost weight; and avoided excessive consumption of alcoholic beverages.

All estimates of health benefits and economic savings are only approximate, because of inaccuracies in measuring sodium consumption and blood pressure and in correlating changes in sodium intake with changes in disease rates. However, the estimates likely understate the benefits, because they do not consider kidney disease, nonfatal strokes and heart attacks, and other health problems that high-sodium diets cause.

## U.S. Attitudes: Regulators, Doctors, Consumers

### The FDA Blasé about Sodium

Over the past two decades, the FDA has done little to push industry to lower foods' sodium levels, preferring to engage in more passive monitoring activities. In 1985 then-commissioner Frank Young emphasized the value of consumer education, but rejected setting limits on sodium, noting that “We continue to believe that our approach is a reasonable and appropriate one, and that action on the GRAS status of salt [i.e., changing it from a ‘generally recognized as safe’ product to a ‘food additive’ designation] is not necessary at this time.”<sup>49</sup> And, despite a published commitment (in the FDA’s 1987 phase II action plan) to “actively pursue major initiatives such as the comprehensive awareness programs dealing with sodium and cholesterol labeling,”<sup>50</sup> no meaningful awareness program was ever undertaken.

The FDA did monitor the sodium content of a set of packaged foods as part of a broad survey initiative in the mid-1980s and found that:<sup>51</sup>

The food industry, on the whole, has not reduced the sodium content of established product lines...When declared sodium values for products from the Food Label and Package Surveys (FLAPS) were weighted by volume of food sold, the pre-1981 average was 500 mg/100 g and the post-1981 average was 499 mg/100 g.

The FDA noted that some companies had begun introducing some new lowered-sodium products instead of reducing sodium levels in their standard products. The agency did not, however, acknowledge that those niche products, though welcomed by people restricting their sodium intake, were not terribly popular among the general population for reasons of cost, taste, and limited availability.

## REGULATING SALT AND SODIUM

### The 1970s

By the 1970s, health experts were urging food manufacturers to lower sodium levels and urging consumers to reduce their sodium intake. What was lacking was useful information on food labels and an adequate variety of low-sodium foods. To improve public policies, in 1978, CSPI (with legal assistance from Georgetown University School of Law's Institute for Public Interest Representation) petitioned the FDA to limit sodium levels in processed foods, to change salt's regulatory status from that of a Generally Recognized As Safe (GRAS) ingredient to a food additive (food additives are typically more tightly regulated than GRAS substances), and to require the amount of sodium per serving to be listed on labels. CSPI also asked the FDA to require a special symbol on foods high in sodium.

In 1979, CSPI's case was buttressed when the Federation of American Societies for Experimental Biology, in a review commissioned by the FDA, told the agency that salt consumption should be lowered and that the agency should develop guidelines for restricting the amount of salt in processed foods.<sup>xiii</sup>

### The 1980s

The FDA in 1982 finally responded to the mounting concern about sodium by requiring that sodium be listed on food labels whenever nutrition labeling was required (as it was when companies made nutrition claims or added nutrients) or provided voluntarily.<sup>xiv</sup> But the FDA denied CSPI's petitions. It said that regulating salt as a food additive would require setting limits on salt's use, and "such limitations would be too difficult, costly, and time-consuming."<sup>xv</sup> The FDA also rejected mandatory sodium labeling for all foods because "the regulatory burden that would be imposed...is not justified."

In 1983, CSPI sued the FDA to take stronger action, but the federal court rejected the lawsuit, saying it was reasonable for the FDA to see how effective its labeling measure would be in reducing sodium intake before doing more.<sup>xvi</sup> The court accepted the FDA's assurance that "if there is no substantial reduction in the sodium content of processed foods...the FDA will consider additional regulatory actions, including proposing a change in salt's GRAS status."<sup>xvii</sup>

### Today

It's now 20 years later, but sodium levels in foods have changed little and sodium consumption has increased. Thanks to Congress, not the FDA, sodium must now be listed on most food labels. Other than that labeling law, Congress, HHS (the FDA's parent agency), and USDA have done virtually nothing to reduce sodium consumption.

Costs and side effects notwithstanding, drugs are seen as being a lot easier than putting in the time and energy required to make substantive lifestyle changes. But that tradeoff may be a dangerous one.

Responding to public and congressional pressure in the late 1980s, the FDA proposed requiring nutrition labels on all foods. Congress trumped the agency by passing the comprehensive Nutrition Labeling and Education Act of 1990. That law put sodium information on most food labels and also defined such terms as sodium-free, low-sodium, and reduced-sodium. Unfortunately, the nutrition labeling law has not led to reduced sodium consumption, though it might have helped hold down increases.

The FDA's food division has continued to ignore the serious health risks posed by high-sodium diets. It has not once included lowering of sodium intake on its annual lists (1999–2005) of priorities. Food allergies, mad cow disease, cosmetics safety, and pesticides were all ranked on those lists, but not salt. According to a former top FDA official, sodium simply has not been an issue at the agency. That is further evidenced by the fact that no FDA staff member is currently charged with developing measures to lower sodium consumption.

### Doctors Prefer Drugs

Most physicians give no more than lip service to preventing or treating high blood pressure with recommendations for weight loss, exercise, reduced alcohol consumption, and improved diets (those lower in sodium and higher in fruits and vegetables). And when doctors do tell patients to cut the salt, many are not aware that people get far more sodium from processed foods and restaurant meals than from the salt they use in cooking or add to foods at home.

Instead, the medical community's general approach has been to identify people who have high blood pressure and prescribe them drugs—notwithstanding the drugs' costs and side effects, which range from drowsiness to sexual impotence to heart disease.<sup>52</sup> Drugs are seen as being a lot easier—for both patients and physicians—than putting in the time and energy required to make substantive lifestyle changes.

But that tradeoff may be a dangerous one. Some 15 years ago, leading hypertension researchers explained that “Despite gratification with [effective drug treatments], there is legitimate concern about the balance between benefit and risk with decades-long use of drugs, on a mass-scale, particularly for persons with less severe hypertension.”<sup>53</sup> Even if lifestyle changes do not always bring blood pressure down to the normal range (though they are effective in many people), such changes almost always allow for lower doses or the elimination of drugs that cost us in terms of dollars, time, and side effects.

## Diminishing Consumer Concern about Sodium

Annual surveys sponsored by the Food Marketing Institute—the supermarket industry’s trade association—show that the public’s concern about salt’s harmfulness has steadily diminished, as controversies over low-carb diets, trans fat, genetically engineered foods, and other topics have dominated the headlines.

- The percentage of people who said they were eating less salt/sodium dropped steadily from 13 percent in 1996 to 5 percent in 2004.
- The percentage of people who considered sodium content the most important nutrition concern rose from 18 percent in 1983 to a peak of 30 percent in 1990, but dropped to 14 percent in 2004.
- Only 7 percent of shoppers looked at the sodium content of foods when reading nutrition or ingredient labels in 2004. Twice that percentage looked at the calorie content, and seven times as many people looked at the fat content.
- The percentage of people who agreed that salt was a serious health hazard slid from 43 percent in 1987 to 30 percent in 1994, the last year the question was asked.

Another measure of consumers’ declining interest in salt is that fewer new “no salt” or “low salt” foods are being introduced. Compared to 15 years ago, the number of lower-sodium products being introduced each year has dropped by about 50 percent (figure 6).<sup>54</sup>

Clearly, stronger efforts—on the part of both the government and health advocacy groups—are needed to persuade consumers of the importance of reducing sodium consumption.

## Experts Say “Reduce Sodium!”

### In the United States...

The FDA’s inaction on, and the medical community’s indifference to, sodium contrasts starkly with the scientific community’s pleas to reduce sodium consumption. The great majority of Americans are destined to suffer from high blood pressure as they age. But most doctors and health officials are content to let their patients develop the disease and then treat

**Figure 6**  
Number of no-, low-, or reduced-sodium foods introduced each year, 1989–2004



Source: Productscan Online.

it, patient by patient, with drugs. Of course, treatment does not help for those people who never seek it, because of lack of health insurance or other reasons.

The public health approach to a disease caused by known “environmental” factors—in this case, high-sodium diets with inadequate fruits and vegetables, inadequate exercise, obesity, drinking too much alcohol—is to attack those factors on a population-wide basis. Scientists have found that in some cultures blood pressure remains low throughout people’s lives; they contend that that should be the goal in our society. Stamler and his colleagues note that improved diets and other lifestyle approaches could achieve that goal, adding that the consequences of that “would be great in saving of lives and extension of life expectancy with health for adults of future generations.”<sup>55</sup>

The consensus that has emerged over the past 50 years on sodium’s being a major cause of cardiovascular disease is expressed in the increasingly stringent recommendations that have been made by HHS, in its series of

*Healthy People* reports, and others (see box at left). The first edition of *Healthy People*, published in 1979, states “it is not clear how much the range of salt intake current today in the United States contributes to the prevalence of hypertension, or how much would be achieved in prevention by a broad reduction in salt (sodium) use...”<sup>56</sup> In 2000, *Healthy People 2010* set a goal of increasing the proportion of people who consume 2,400 mg or less of sodium daily from 21 percent to 65 percent.<sup>57</sup>

HHS may have recommended goals, but the agency did not follow up with a focused effort to achieve them. The notion of tripling the percentage of people who consume 2,400 mg or less of sodium is laughable in the absence of voluntary industry initiatives and aggressive government actions.

#### Daily Sodium Recommendations for Americans

1980 – National Academy of Sciences’ *Recommended Dietary Allowances*: **1,100–3,000 mg**

1989 – National Academy of Sciences’ *Diet and Health*: Initial goal of **2,400 mg**; “a greater reduction... [to **1,800 mg** or less] would probably confer greater benefits”

2004 – Institute of Medicine’s “Acceptable Intake”:

- People under 50: **1,500 mg**
- People 50–70: **1,300 mg**
- People over 70: **1,200 mg**

2005 – Dietary Guidelines Advisory Committee:

- Youths, young adults: **no more than 2,300 mg**
- Hypertensive individuals, blacks, and middle- and older-aged adults: **no more than 1,500 mg**

Since 1980, every edition of *Dietary Guidelines for Americans*, which is published jointly by the USDA and HHS, has advised Americans to reduce their intake of sodium. In 1980, the guidelines simply advised the public to “Avoid Too Much Sodium.” In 2004, the report of an academic committee advising the government on the 2005 edition of the *Dietary*

*Guidelines* states: “The relationship between salt (sodium chloride) intake and blood pressure is direct and progressive without an apparent threshold. Hence, individuals should reduce their salt intake as much as possible.”<sup>58</sup>

The 2005 *Guidelines* recommends that healthy young adults consume less than 2,300 mg of sodium per day. Individuals with hypertension, blacks, and middle-aged and older adults—almost half the population—are advised not to consume more than 1,500 mg of sodium per day.<sup>59</sup>

Perhaps the boldest recommendation for reducing sodium levels has come from the American Public Health Association. In 2002, the association advocated a 50 percent reduction in sodium in processed and restaurant foods over the next 10 years, or 5 percent per year for 10 years.<sup>60</sup> That goal was endorsed in 2003 in the *Seventh Report of the Joint National Committee on the Prevention, Detection, Evaluation, and Treatment of High Blood Pressure*.<sup>61</sup> And that report was approved by the National High Blood Pressure Education Program Coordinating Committee, which is chaired by the director of NHLBI and consists of representatives from 39 major medical organizations, voluntary health organizations (including the American Heart Association), the Centers for Disease Control and Prevention, and several institutes of the National Institutes of Health.

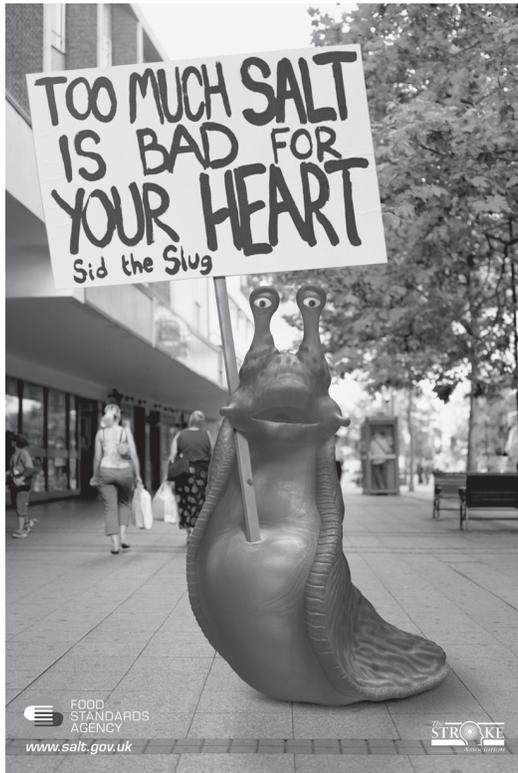
The need to reduce sodium levels in processed and restaurant foods was one conclusion from the Trials of Hypertension Prevention II study.<sup>62</sup> Though most of the participants tried hard to reduce their sodium intake—and the average person consumed one-fourth less sodium—only one out of five people reached the target of a 50 percent reduction. The researchers concluded that: “From these beneficial but modest results with highly motivated and extensively counseled individuals, sodium reduction sufficient to favorably influence the population blood pressure distribution will be difficult to achieve without food supply changes.”

In other words, if you live in a society where salty processed and restaurant foods abound, it’s tough to lower your salt intake to a safe level.

### ...and Abroad

People in most modern societies consume diets high in sodium and suffer unnecessarily high rates of high blood pressure, heart disease, and stroke. Some governments and private agencies have sought to turn the tide and lower sodium intakes. Their examples could serve as models for the United States.

If you live in a society where salty processed and restaurant foods abound, it’s tough to lower your salt intake to a safe level.



Advertisement, Food Standards Agency.

**United Kingdom.** The British government's Food Standards Agency (which is similar to the FDA) began a major public campaign in 2003 to encourage food manufacturers to reduce sodium levels in their products.<sup>63</sup>

The agency identified the contribution of various categories of food to overall sodium consumption. It then specified a target for lowering the sodium content in each category. For example, the agency proposed a 55 percent reduction in the sodium content of canned soups, a 29 percent reduction in cheeses, and an 81 percent reduction in canned vegetables. The program's goal is to reduce sodium consumption by one-third over the next five years, from 3,780 mg (including salt added at the table) to 2,440 mg. The agency has publicized widely different levels of sodium in various brands of pizza, baked beans, and other processed foods and criticized such prominent companies as Nestlé, Heinz, and McDonald's.<sup>64</sup> That approach is spurring some companies to make significant sodium reductions. For example, Heinz reduced the salt content in its baked beans by 30 percent; and McDonald's lowered the sodium content in the average Happy Meal by 20 percent.<sup>65</sup> Marks & Spencer, a major grocery chain, has cut salt in bread by 20 percent, in ready meals by 30 percent, and in pizzas by 9 percent. Preceding the government initiative, in 1999 the Sainsbury's supermarket chain started reducing sodium levels in its store-brand foods by 10 to 15 percent. The reduction has saved the equivalent of almost 400 tons of salt per year.<sup>66</sup>

**Ireland.** The Food Safety Authority of Ireland is pressing the food industry to decrease sodium levels in processed and restaurant foods by one-third.<sup>67</sup> The government is focusing first on cutting the sodium content by 50 percent in the five biggest sources of sodium, including bread, cured meats, meat dishes, and breakfast cereals. The baking industry has agreed to an initial 10 percent reduction.

**New Zealand and Australia.** The National Heart Foundation in New Zealand and Australia developed a "Pick the Tick" labeling program that allows companies to put a checkmark ("tick") on products that meet criteria for sodium and other substances, including less than 400 mg of sodium per 100 g (3.5 oz). The program has been moderately successful in attracting consumers to buy and encouraging companies to market more-healthy products.<sup>68</sup> Between July 1998 and June 1999, New Zealand companies cut about 33 tons of salt from 23 breads, breakfast

cereals, and margarines. The average sodium content of breakfast cereals declined by 61 percent, bread by 26 percent, and margarine by 11 percent. One major company in Australia used the “tick” criteria to reduce salt in 12 breakfast cereals by an average of 40 percent.<sup>69</sup> Overall, Australian companies eliminated 235 tons of salt annually.

**Finland.** At one time, Finland limited the salt content of such foods as soups, broths, and sauces, but European Union laws forced it to drop some of those limitations.<sup>70</sup> Today, Finland limits salt only in baby foods. Like the United States, Finland allows companies to claim that foods are low-salt if they contain less than a specified amount of salt. However, Finland requires foods that exceed specified limits to be labeled as “high-salt.”<sup>71</sup> Finland’s long-standing focus on sodium has led to a 30 percent decline in consumption between the late 1970s and late 1990s (from roughly 4,700 to 3,300 mg per day).<sup>72</sup> In addition, the Finnish Heart Association has developed a healthy-food symbol that companies can use on labels of processed meats, dairy products, grain products, and certain other categories that meet criteria for sodium and other nutrients.<sup>73</sup>

**France.** The French government’s National Nutrition Health Program has set a goal of reducing systolic blood pressure by 10 mm Hg, partly by reducing salt consumption.<sup>74</sup> The National Academy of Medicine has called for a 20 percent reduction in salt intake over five years.<sup>75</sup> The government’s regulatory agency established a Salt Working Group that recommended lowering the salt content of bread by 4 percent per year for five years and cutting sodium in meat, cheese, and other foods.<sup>76</sup>

**Belgium.** Belgium’s Ministry of Health decades ago ordered that the salt content of bread produced in the country be reduced. Between 1976 and 1978, the salt content was gradually reduced by 23 percent.<sup>77</sup>

**World Health Organization.** Much of the world looks to the World Health Organization (WHO) for authoritative advice on improving health. WHO is encouraging governments to improve public health by improving diets, including lowering sodium consumption. In 2002, WHO estimated that mandatory food labeling and voluntary industry actions could lead to 30 percent reductions in sodium.<sup>78</sup> In its 2003 report *Diet, Nutrition, and the Prevention of Chronic Diseases*, WHO states that “All these data show convincingly that sodium intake is directly associated with blood pressure” and recommends that sodium consumption be less than 2,000 mg per day.<sup>79</sup> In its 2004 *Global Strategy on Diet, Physical Activity, and Health*, WHO says that “Governments could...encourage the reduction of the salt content of processed foods” by



Finnish Heart Association logo.

“The obstinate pursuit of purely commercial interests by the salt industry and some food companies is responsible for thousands of avoidable deaths and disability from stroke and coronary heart disease.”

— F.P. CAPPUCCIO, N.D. MARKANDU, C. CARNEY, AND OTHERS<sup>xviii</sup>

encouraging “healthy diets at schools and limit[ing] the availability of products high in salt, sugar, and fats.”<sup>80</sup> It also calls on food processors to reduce the salt content of processed foods and to be careful about marketing foods high in salt and other unhealthful ingredients to children.

## Roadblocks to Reducing Sodium

Though almost all hypertension experts believe that sodium levels in the food supply should be lowered, little progress has been made. The lack of progress can be blamed on three parties: a small number of researchers who disagree with the majority, the food industry, and us consumers.

### We Like Salt...

Reducing sodium levels in foods, and consumption, is harder than it might seem. The first problem is replacing the taste normally provided by salt, a taste preference that is instinctive.<sup>81</sup> Sometimes companies just remove the salt without replacing it with herbs, spices, or other real food ingredients. As many consumers have discovered, salt-free or low-sodium foods also may be taste-free. That’s one reason why low- or reduced-sodium foods account for less than 5 percent of sales.<sup>82</sup> The food industry has tried, but failed, to develop a salt substitute analogous to the popular sugar substitutes. The closest thing to a direct substitute is potassium chloride, but that substance tastes extremely bitter to many people.

In the end, a mix of measures will be needed to slash sodium levels: cutting down, but not cutting out, the salt; using spices, vegetables, or other flavorful ingredients judiciously; and developing processing methods that do not create off-flavors. Cutting sodium in some foods is easy. Researchers lowered sodium by 50 to 90 percent in chicken stew, chicken with rice, and other foods without affecting consumer acceptance.<sup>83</sup> In other cases, reducing sodium is more difficult. Many people experience “taste shock” when they suddenly switch to a lower-sodium diet, but some say that a lower-sodium diet allowed them to taste the real flavor of the food itself. Gradual reductions in sodium may be easier to accept. Backing up that approach, an Australian study found that people could barely, if at all, detect when the sodium content of bread was reduced by 25 percent over six weeks.<sup>84</sup> Government-set restrictions that covered entire industries would overcome some companies’ fears that they would lose sales if they, but not their competitors, used less salt.

“The salt producers and some food manufacturers continue to do their best to obfuscate the evidence, usually surreptitiously, but occasionally in public.”

— T.F.T. ANTONIOS AND G.A. MACGREGOR<sup>xix</sup>

### ...And the Salt Institute Wants to Keep It That Way

The Salt Institute, a trade association, barrages government agencies and expert committees with its pro-salt interpretation of the scientific evidence.<sup>85</sup> It has aimed its fire at HHS, WHO, and others. In a letter the lobbying group sent to the advisory committee preparing the *2005 Dietary Guidelines for Americans* report, Salt Institute president Richard L. Hanneman stated simply, “There should be no guideline for salt.”<sup>86</sup> That demand echoed an earlier Salt Institute letter that unsuccessfully sought to derail the *2000 Dietary Guidelines for Americans*, which ultimately advised people to “choose and prepare foods with less salt.”

The Salt Institute acknowledges that salt raises blood pressure in some people, but contends that the best way to fight hypertension is to consume lots of fruits and vegetables, eat a diet low in saturated fat and cholesterol, lose weight, avoid excessive drinking, and exercise. It also advocates for an individualized medical approach of identifying and treating those people who have hypertension. Those lifestyle changes are sensible and should be made, and people with hypertension should of course be treated.

What the institute refuses to recognize, however, is that when a health problem affects a huge segment of the population—110 million Americans have hypertension or pre-hypertension—a more encompassing, society-wide solution is needed. The public health approach would create an environment that reduces the risk of disease. Less-salty prepared foods certainly would help the millions of people who already have hypertension, regardless of whether they are on medication. And while lower sodium levels would provide only slight, near-term benefits to many people with normal blood pressure, the lower levels would help many of those people postpone or avoid high blood pressure as they age.

### Minority Opinions among Researchers

Several vocal academic researchers have opposed reducing sodium consumption in the general population. They base their position on studies that are inconsistent with most of the research, or they argue that hypertension is best treated on an individual basis.<sup>87, 88</sup> Most hypertension experts, though, have concluded that the research the contrarians cite is either flawed, misinterpreted, or so fragmentary as not to negate the great body of well-done research that shows that salt tends to increase blood pressure and that high blood pressure is harmful to large segments of the population.<sup>89, 90</sup>

“It is critical that the food industry reduce (or continue to reduce, in some cases) the content of sodium in generally available processed foods, in addition to offering special low-salt products, e.g., gradually lower salt in bread by 10, 20, and 30 percent.”

— NATIONAL INSTITUTES OF HEALTH<sup>xx</sup>

Food manufacturers and consumers can do a certain amount on their own. But to obtain meaningful and lasting change, government needs to act.

## An Agenda for Action

Experts who have struggled to lower consumers' sodium intake have concluded that “Imploring individuals to reduce sodium consumption alone is likely to have little effect.”<sup>91</sup> That’s because high-sodium content is the norm for processed foods and restaurant meals. The National High Blood Pressure Education Program has emphasized that “Given that sodium added during processing of foods accounts for approximately three-quarters of an individual’s total sodium intake, any meaningful reduction in sodium intake is predicated on a decrease in dietary sodium from [processed] food sources.”<sup>92</sup>

Northwestern University’s Stamler says that “the fight against the blood pressure problem is being fought with one arm tied behind our backs.”<sup>93</sup> He emphasizes the need to wage a *two-front* war on hypertension. The first front—identifying people with hypertension and treating them with drugs—is being waged with some success because the pharmaceutical industry is a strong ally and there is no corporate opponent. To complement that medical approach, Stamler advocates a population-wide *prevention* strategy. Food manufacturers and consumers can do a certain amount on their own. But to obtain meaningful and lasting change, government needs to act. CSPI offers the following recommendations for government action.

- The FDA should change salt’s regulatory status from “Generally Recognized As Safe” to “food additive.” That change would establish the basis for regulatory efforts by the FDA to limit the sodium content of processed foods.
- The FDA and USDA should set sodium limits for those categories of processed foods that are the biggest sources of sodium. Those limits could be based on the amounts in the lowest-sodium brands, or the median sodium content, in each category. Industry would be given several years to comply. Once products were in compliance, the limits could be reduced to the new median (or other lower) value. Congress should provide funding for a new FDA Division of Salt Reduction that would develop and implement regulations.
- Congress should consider levying taxes on saltier foods, with the revenues earmarked for promoting healthier diets and more physical activity.

- The FDA and USDA should develop attention-getting symbols, for use on the fronts of food packages, to signify high or low sodium content. Such labels would be much more effective than current labels in encouraging companies to produce and consumers to choose lower-sodium brands. (Symbols also should highlight a food's content of saturated/trans fat, sugar, cholesterol, and dietary fiber.)
- The federal government, or states, should require chain table-service restaurants to list the sodium (and calorie and saturated/trans fat) content next to each food or meal on menus. Fast-food chains should list calories on their menu boards and provide brochures with sodium and other nutrition information.
- Regardless of whether they set sodium limits or require better labeling, FDA and USDA officials should prod manufacturers to use less salt. U.S. officials should copy their British counterparts and set targets for various food categories, mount well-funded education campaigns, and publicly criticize the biggest corporate offenders.
- Though we get relatively little of our salt from canisters bought at the supermarket, it would be useful for the FDA to require canister labels to bear a health notice, such as "Salt promotes heart disease. Use less. Try using half as much salt as called for in recipes."
- Because sodium is only one of several factors that cause cardiovascular disease, the federal government should sponsor major campaigns to promote diets rich in vegetables, beans, fruit, and nuts, along with some seafood, lean meat and poultry, and fat-free dairy products. It should also help schools serve more-healthy meals, provide financial incentives to farmers to produce more healthful foods, and give bonus food stamps for fruits and vegetables. Finally, it should support measures to promote weight loss, discourage heavy drinking, and encourage physical activity.

Reducing salt consumption is one of the single most effective ways to prevent heart disease and strokes. Ways to do so are clear. What is needed is vigorous action by policy makers and cooperation from the food industry to make the healthy choice the easy choice for consumers.



## Notes

1. National Center for Health Statistics. *Health, United States, 2004, With Chartbook on Trends in the Health of Americans*. Hyattsville, MD, 2004. Tables 37, 67.
2. Tobian L. Statement. Subcommittee on Investigations and Oversight, Committee on Science and Technology, U.S. House of Representatives. April 13, 1981.
3. Murray CJL, Lauer JA, and Hutubessy RCW. Effectiveness and costs of interventions to lower systolic blood pressure and cholesterol: a global and regional analysis on reduction of cardiovascular-disease risk. *Lancet*. 2003; 361:717–25.
4. National High Blood Pressure Education Program, National Heart, Lung, and Blood Institute, National Institutes of Health. National High Blood Pressure Education Program Working Group report on primary prevention of hypertension. *Arch Intern Med*. 1993; 153:186–208.
5. Salt Institute. U.S. Salt Sales: Human Nutrition Salt. [www.saltinstitute.org/33.html](http://www.saltinstitute.org/33.html) (accessed September 22, 2004). Data are available for 2000–03, but a major producer dropped out of the survey in 2000, so data for those years are not comparable to the previous data set.
6. U.S. Department of Agriculture. Continuing Study of Food Intakes of Individuals, 1994–96.
7. Institute of Medicine, National Academies. *Dietary Reference Intakes: Water, Potassium, Sodium, Chloride, and Sulfate*. Washington, DC: National Academies Press, 2004. P. 6-1.
8. Mancilha-Carvalho JJ, Souza e Silva NA. The Yanomami Indians in the INTERSALT study. *Arq Bras Cardiol*. 2003; 80:295–300.
9. Havas S, Roccella EJ, Lenfant C. Reducing the public health burden from elevated blood pressure levels in the United States by lowering intake of dietary sodium. *Am J Pub Health*. 2004; 94:19–22.
10. Institute of Medicine, op cit. P. 6-44.
11. Mattes RD, Donnelly D. Relative contributions of dietary sodium sources. *J Am Coll Nutr*. 1991; 10:383–93.
12. Cotton PA, Subar AF, Friday JE, et al. Dietary sources of nutrients among US adults, 1994 to 1996. *J Am Diet Asso*. 2004; 104:921–30.
13. Schorr U, Distler A, Sharma AM. Effect of sodium chloride- and sodium bicarbonate-rich mineral water on blood pressure and metabolic parameters in elderly normotensive individuals: a randomized double-blind crossover trial. *J Hypertens*. 1996; 14:131–5.
14. Luft FC, Zemel MB, Sowers JA, et al. Sodium bicarbonate and sodium chloride: effects on blood pressure and electrolyte homeostatis in normal and hypertensive man. *J Hypertens*. 1990; 8:663–70.
15. Economic Research Service, U.S. Department of Agriculture. *America's Eating Habits: Changes and Consequences*. Agriculture Information Bulletin No. 750. 1999. Chapter 12.
16. Jacobson MF, Hurley J. *Restaurant Confidential*. New York: Workman, 2002.
17. Jacobson M. Sodium content of processed foods: 1983–2004. *Am J Clin Nutr*. 2005. (In press.)
18. Mudd M, Kraft Foods. Pers. comm. Sept. 2004.
19. Stamler J. The INTERSALT study: background, methods, findings, and implications. *Am J Clin Nutr*. 1997; 65(suppl):626S–42S.
20. Department for Environment, Food and Rural Affairs. National Food Survey 2000. London: The Stationery Office, 2001, and previous editions. Household consumption of table salt, 1960–2000, Great Britain. [www.heartstats.org](http://www.heartstats.org) (British Heart Foundation) (accessed Sept. 22, 2004).

21. National Institutes of Health. *Implementing Recommendations for Dietary Salt Reduction*. Pub. No. 55-728N. 1996.
22. Fields LE, Burt VL, Cutler JA, et al. The burden of adult hypertension in the United States 1999 to 2000: a rising tide. *Hypertension*. 2004; 44:398–404.
23. Hajjar I, Kotchen TA. Trends in prevalence, awareness, treatment, and control of hypertension in the United States, 1988–2000. *JAMA*. 2003; 290:199–206.
24. Vasan RS, Beiser A, Seshadri S. Residual lifetime risk for developing hypertension in middle-aged women and men. *JAMA*. 2002; 287:1003–10. The subjects in the Framingham study are white; for African Americans, the chances of developing hypertension may be even higher.
25. Chobanian AV, Bakris GL, Black HR, et al. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. *JAMA*. 2003; 289:2560–72. National Heart, Lung, and Blood Institute. NHLBI issues new high blood pressure clinical practice guidelines. News release. May 14, 2003.
26. National Heart, Lung, and Blood Institute. *Ibid*.
27. Khaw KT, Bingham S, Welch A, et al. Blood pressure and urinary sodium in men and women: the Norfolk Cohort of the European Prospective Investigation into Cancer (EPIC–Norfolk). *Am J Clin Nutr*. 2004; 80:1397–403.
28. Sacks FM, Svetkey LP, Vollmer WM, 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.
29. Bray GA, Vollmer WM, Sacks FM, et al. A further subgroup analysis of the effects of the DASH diet and three dietary sodium levels on blood pressure: results of the DASH-Sodium Trial. *Am J Cardiol*. 2004; 94:222–7.
30. Obarzanek E, Proschan MA, Vollmer WM, et al. Individual blood pressure responses to changes in salt intake: Results from the DASH–sodium diet. *Hypertension*. 2003; 42:459–67.
31. Kumanyika SK, Cook NR, Cutler JA, et al. Sodium reduction for hypertension prevention in overweight adults: further results from the Trials of Hypertension Prevention Phase II. *J Hum Hypertens*. 2005; 19:33–45.
32. Cook NR, Kumanyika SK, Cutler JA, et al. Dose–response of sodium excretion and blood pressure change among overweight nonhypertensive adults in a 3-year dietary intervention study. *J Hum Hypertens*. 2005; 19:47–54.
33. Cutler JA, Follmann D, Allender PS. Randomized trials of sodium reduction: an overview. *Am J Clin Nutr*. 1997; 65(suppl):643S–51S.
34. Whelton PK, Appel LJ, Espeland MA, et al. Sodium reduction and weight loss in the treatment of hypertension in older persons (TONE). *JAMA*. 1998; 279:839–46.
35. Prospective Studies Collaboration. Age-specific relevance of usual blood pressure to vascular mortality: a meta-analysis of individual data for one million adults in 61 prospective studies. *Lancet*. 2002; 360:1903–13.
36. MacMahon S, Peto R, Cutler J, et al. Blood pressure, stroke, and coronary heart disease. Part 1, prolonged differences in blood pressure: prospective observational studies corrected for the regression dilution bias. *Lancet*. 1990; 335:765–74.
37. Mancilha-Carvalho JJ, Souza e Silva NA., op cit.
38. Prospective Studies Collaboration, op cit.
39. Cutler JA, Follmann D, Allender PS. op cit. Cutler J. Pers. comm. Dec. 27, 2004.
40. Cook NR, Cohen J, Hebert PR, et al. Implications of small reductions in diastolic blood pressure for primary prevention. *Arch Intern Med*. 1995; 155:701–9.
41. Stamler J, Stamler R, Neaton JD. Blood pressure, systolic and diastolic, and cardiovascular risks. *Arch Intern Med*. 1993; 153:598–615.

42. He FJ, MacGregor GA. How far should salt intake be reduced? *Hypertension*. 2003; 42:1093–9. (CSPI averaged the percentage reductions based on systolic and diastolic blood pressures.)
43. Tuomilehto J, Jousilahti P, Rastenyte D, et al. Urinary sodium excretion and cardiovascular mortality in Finland: a prospective study. *Lancet*. 2001;357:848–51.
44. National Heart, Lung, and Blood Institute. *Morbidity and Mortality: 2004 Chartbook on Cardiovascular, Lung, and Blood Diseases*. 2004. Chart 2-8.
45. Havas S, Roccella EJ, Lenfant C., op cit.
46. Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. The Sixth Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. *Arch Intern Med*. 1997; 157:2413–46.
47. 68 *Fed. Reg.* 41490. Table 12.
48. Longwell LS. Pers. comm. Sept. 27, 2004.
49. Young FE. Letter to CSPI. April 9, 1985.
50. Food and Drug Administration. *A Plan for Action, Phase II*. 1987. P. 18.
51. Division of Consumer Studies, Center for Food Safety and Applied Nutrition, Food and Drug Administration. *Sodium Content of the Retail Food Supply: 1986*. Food Label and Package Survey. 1987.
52. E.g., Hypertension: medications to lower blood pressure. Cardiology Channel. [www.cardiologychannel.com/hypertension/pharm.shtml](http://www.cardiologychannel.com/hypertension/pharm.shtml) (accessed Jan. 2, 2005). Wassertheil-Smoller S, Psaty B, Greenland P, et al. Association between cardiovascular outcomes and antihypertensive drug treatment in older women. *JAMA*. 2004; 292:2849–59.
53. Stamler R, Stamler J, Gosch FC, et al. Primary prevention of hypertension by nutritional-hygienic means. Final report of a randomized, controlled study. *JAMA*. 1989; 262:1801–7.
54. Vierhile T, Productscan Online. Pers. comm. Jan. 7, 2005.
55. Stamler J, Stamler R, Neaton JD. op cit.
56. U.S. Department of Health and Human Services. *Background Papers. Healthy People: The Surgeon General's Report on Health Promotion and Disease Prevention*. 1979. P. 179.
57. U.S. Department of Health and Human Services. *Healthy People 2010*. 2000. Pp. 19–30.
58. U.S. Department of Health and Human Services and U.S. Department of Agriculture. *Report by the Dietary Guidelines Advisory Committee*. 2004. P. D-10:8.
59. U.S. Department of Health and Human Services, U.S. Department of Agriculture. *Dietary Guidelines for Americans*. 2005. P. 40.
60. Resolution: Reducing the Sodium Content of the American Diet. Washington, DC: American Public Health Association, 2002. Cited in Havas S, Roccella EJ, Lenfant C., op cit.
61. Chobanian AV, Bakris GL, Black HR, et al., op cit.
62. Kumanyika SK, Cook NR, Cutler JA, et al., op cit.
63. See various documents at [www.food.gov.uk](http://www.food.gov.uk).
64. Sherman J, Kennedy D. Food giants shamed over high salt content. *The Times (London)*. June 17, 2004.
65. Ibid.
66. Salt reduction at Sainsbury's. [www.sainsburys.co.uk/food\\_issues/](http://www.sainsburys.co.uk/food_issues/) (accessed Jan. 2, 2005).
67. Anderson W, Food Safety Authority of Ireland. Pers. comm. Nov. 8, 2004.

68. Young L, Swinburn B. Impact of the Pick the Tick food information programme on the salt content of food in New Zealand. *Health Promot Int.* 2002; 17:13–9.
69. Williams P, McMahon A, Boustead R. A case study of sodium reduction in breakfast cereals and the impact of the Pick the Tick food information program in Australia. *Health Promot Int.* 2003; 18:51–6.
70. National Public Health Institute. Ed. Marjaana Lahti-Koski. *Nutrition in Finland*. [www.ktl.fi/nutrition/nutrition.pdf](http://www.ktl.fi/nutrition/nutrition.pdf) (accessed Nov. 11, 2004). P. 16.
71. *Ibid.*, p. 17.
72. Average of urinary sodium excretion in men and women. Data from the Finnish National Public Health Institute and other surveys.
73. National Public Health Institute, *op cit.*, p. 17.
74. National Nutritional Health Programme: 2001–2005. (Received Nov. 8, 2004.)
75. Académie Nationale de Médecine. Salt intake and blood pressure. Summary in English; undated. (Received Nov. 8, 2004.)
76. Report of the Salt Working Group. 2002.
77. Stamler J. *op cit.*
78. World Health Organization. *The World Health Report 2002: Reducing Risks, Promoting Healthy Life*. Geneva. 2002.
79. World Health Organization. Diet, Nutrition and the Prevention of Chronic Diseases. Geneva. 2003. P. 85.
80. 57th World Health Assembly. Global Strategy on Diet, Physical Activity, and Health. Agenda item 12.6. Geneva: World Health Organization, May 22, 2004.
81. MacGregor GA. Dietary sodium and potassium intake and blood pressure. *Lancet*. 1983; i:750–3.
82. *Prepared Foods Magazine*. April 1993.
83. Adams SO, Maller W, Cardello AV. Consumer acceptance of foods lower in salt. *J Am Diet Assoc*. 1995; 95:447–53.
84. Girgis S, Neal B, Prescott J, et al. A one-quarter reduction in the salt content of bread can be made without detection. *Eur J Clin Nutr*. 2003; 57:616–20. Rodgers A, Neal B. Less salt does not necessarily mean less taste. *Lancet*. 1999; 353:1332.
85. Numerous documents are available on the Salt Institute's website, [www.saltinstitute.org](http://www.saltinstitute.org).
86. Hanneman RL. Letter to K. McMurry, Office of Disease Prevention and Health Promotion, U.S. Department of Health and Human Services. April 28, 2004.
87. McCarron DA. The dietary guideline for sodium: should we shake it up? Yes! *Am J Clin Nutr*. 2000; 71:1013–9.
88. Alderman MH, Cohen H, Madhavan S. Dietary sodium intake and mortality: The National Health and Nutrition Examination Survey (NHANES I). *Lancet*. 1998; 351:781–5.
89. Kaplan NM. The dietary guideline for sodium: should we shake it up? No. *Am J Clin Nutr*. 2000; 71:1020–6.
90. Institute of Medicine, National Academies, *op cit.* P. 6-84.
91. Cook NR, Cohen J, Hebert PR, et al., *op cit.*
92. Whelton PK, He J, Appel LJ, et al. Primary prevention of hypertension: clinical and public health advisory from the National High Blood Pressure Education Program. *JAMA*. 2002; 288:1882–8.
93. Kotchen T. Session VII. Research and Public Health Directions. *Hypertension*. 1991; 17(suppl):I-216–21.

## Notes to Boxes and Quotes

- i. Law MR, Frost CD, and Wald NJ. By how much does dietary salt reduction lower blood pressure? *BMJ*. 1991; 302:819–24.
- ii. Zhou BF, Stamler J, Dennis B, et al. Nutrient intakes of middle-aged men and women in China, Japan, United Kingdom, and United States in the late 1990s: The INTERMAP study. *J Hum Hypertens*. 2003; 17:623–30. Kumanyika SK, Cook NR, Cutler JA, et al. Sodium reduction for hypertension prevention in overweight adults: further results from the Trials of Hypertension Prevention Phase II. *J Hum Hypertens*. 2005; 19:33–45.
- iii. Institute of Medicine, National Academies. *Dietary Reference Intakes: Water, Potassium, Sodium, Chloride, and Sulfate*. Washington, DC: National Academies Press, 2004. P. 6-6.
- iv. He FJ, MacGregor GA. Salt, blood pressure and the renin-angiotensin system. *J Renin-Angio-Aldost System*. 2003; 4:11–16.
- v. Obarzanek E, Proschan MA, Vollmer WM, et al. Individual blood pressure responses to changes in salt intake: Results from the DASH–sodium diet. *Hypertension*. 2003; 42:459–67.
- vi. Suhr JA, Stewart JC, France CR. The relationship between blood pressure and cognitive performance in the Third National Health and Nutrition Examination Survey (NHANES III). *Psychosom Med*. 2004; 66:291–97.
- vii. Langa KA, Foster NL, Larson EB. Mixed dementia: emerging concepts and therapeutic implications. *JAMA*. 2004; 292:2901–8.
- viii. Prospective Studies Collaboration. Age-specific relevance of usual blood pressure to vascular mortality: a meta-analysis of individual data for one million adults in 61 prospective studies. *Lancet*. 2002; 360:1903–13.
- ix. Vasani RS, Beiser A, Seshadri S. Residual lifetime risk for developing hypertension in middle-aged women and men. *JAMA*. 2002; 287:1003–10.
- x. Geleijnse JM, Hofman A, Witteman JC, et al. Long-term effects of neonatal sodium restriction on blood pressure. *Hypertension*. 1997; 29:913–17.
- xi. Institute of Medicine, op cit. 6-89–95.
- xii. He J, Ogden LG, Vupputuri S, et al. Dietary sodium intake and subsequent risk of cardiovascular disease in overweight adults. *JAMA*. 1999; 282:2027–34.
- xiii. See discussion in 47 *Federal Register* 26, 592 (June 18, 1982).
- xiv. 47 *Federal Register* 26, 580 (June 18, 1982).
- xv. Letter from JP Hile to MF Jacobson (August 18, 1982); the FDA also noted that many uses of salt are “prior sanctioned” (a third category of food ingredient) and claimed (erroneously, in CSPI’s view) that prior-sanctioned ingredients were exempt from regulation as food additives.
- xvi. U.S. District Court for the District of Columbia, No. 83-801, Memorandum Opinion filed June 11, 1984.
- xvii. 47 *Federal Register* 26, 593 (June 18, 1982).
- xviii. Cappuccio FP, Markandu ND, Carney C, et al. Double-blind randomised trial of modest salt restriction in older people. *Lancet*. 1997; 350:1703.
- xix. Antonios TFT, MacGregor GA. Salt—more adverse effects. *Lancet*. 1996; 348:250–51.
- xx. National Institutes of Health. *Implementing Recommendations for Dietary Salt Reduction*. Pub. No. 55-728N. 1996.







