Sodium, Salt and Your Health: New Guidelines Shaking Things Up

Cynthia Thomson, PhD, RD
Department of Nutritional Sciences and
Program in Integrative medicine
University of Arizona
cthomson@email.arizona.edu

Sponsored by the University of Arizona College of Medicine at the Arizona Health Sciences Center.
Nothing to disclose.

Sodium
• Discovered in 1807 by Sir Humphrey Davy
• name derived from medieval word "sodanum" meaning remedy for headache
• Used in medicine, photography and agriculture
• Generally consumed as NaCl (salt)
  – 168,000,000 tons manufactured annually worldwide

Changing Times
• Much of human history salt was seen as a precious commodity
• Necessary for basic health
• Focus was on adequacy of intake
• That focus shifted as processed, preserved foods became more prevalent and sodium intake increased
• Current AI to provide for needs and replace losses:
  – 1500mg for adults 19-50
  – 1300mg for adults 51-70
  – 1200mg for adults 71 and older
Where does the majority of our sodium come from?

- Source: American Heart Association

### Common Sources of Sodium in US Diet

<table>
<thead>
<tr>
<th>Sample Daily Menu</th>
<th>Sodium Content (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 c. corn or bran flakes</td>
<td>280</td>
</tr>
<tr>
<td>Scrambled egg</td>
<td>50</td>
</tr>
<tr>
<td>3 oz. ham</td>
<td>1000</td>
</tr>
<tr>
<td>2 cups milk</td>
<td>250</td>
</tr>
<tr>
<td>1 c. canned chicken noodle soup</td>
<td>1400</td>
</tr>
<tr>
<td>1 mango</td>
<td>5</td>
</tr>
<tr>
<td>2 oz. Pasta-Roni angel hair pasta w/ parmesan</td>
<td>740</td>
</tr>
<tr>
<td>2 slices white bread</td>
<td>340</td>
</tr>
<tr>
<td>½ cup fresh cooked carrots</td>
<td>40</td>
</tr>
<tr>
<td>1 c. unsalted almonds</td>
<td>1</td>
</tr>
</tbody>
</table>

### Sample Daily Menu

<table>
<thead>
<tr>
<th>Sodium Content (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>280</td>
</tr>
<tr>
<td>50</td>
</tr>
<tr>
<td>1000</td>
</tr>
<tr>
<td>250</td>
</tr>
<tr>
<td>1400</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>740</td>
</tr>
<tr>
<td>340</td>
</tr>
<tr>
<td>40</td>
</tr>
<tr>
<td>1</td>
</tr>
</tbody>
</table>
Why is sodium a concern?

Strong association with rise in blood pressure, CHD and stroke

Classification of Hypertension

<table>
<thead>
<tr>
<th>Category</th>
<th>Systolic</th>
<th>Dystolic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optimal</td>
<td>&lt;120</td>
<td>&lt;80</td>
</tr>
<tr>
<td>Normal</td>
<td>&lt;130</td>
<td>&lt;85</td>
</tr>
<tr>
<td>High normal</td>
<td>130-139</td>
<td>86-89</td>
</tr>
</tbody>
</table>

**Hypertension**

- Stage 1: 140-159 or 90-99
- Stage 2: 160-179 or 100-109
- Stage 3: >180 and/or >110


Global HTN Rates

High blood pressure, a major risk factor globally

Costs Associated with Blood Pressure

Hypertension Costs to Total $73.4 Billion in 2009

- Direct costs = $64.2 billion
- Indirect costs = $19.2 billion

Figure 3: In 2009, total costs associated with hypertension are projected to climb to $73.4 billion, up from $69.4 billion in 2008 and $66.4 billion in 2007. Source: American Heart Association. Heart Disease and Stroke Statistics—2009 Update.
Association Between Na Intake and HTN

- ~ 74.5 million people in the US age 20 and older have HTN (AHA)
  - Of those, about 25% were unaware of their condition
- 40 years of research has shown that more than 2400mg sodium daily is associated with elevated blood pressure
- Persistent elevated blood pressure (Hypertension, HTN) contributes to stroke, cardiovascular disease, and renal disease

*In white, normotensive, 65 year old adults

Dietary Salt and BP Rise

Adjusted dietary intake vs. BP rise

Elliott, 1996; Meneton, 2005

Added Salt and BP in Various Populations

Added salt intake vs. BP rise

Joossens, 1980; Meneton, 2005
Salt Sensitivity

- Definition: ↓BP of 10 mm Hg or 10% with salt restriction
- Variable responsiveness to change in blood volume
- Associated with renal function
- Altered renin-angiotension system
- Genetic component?

- 50% of subjects with HTN, 25% normotensive
- Most people have some BP-lowering response to sodium restriction

Sodium and Cardiovascular Disease Risk

<table>
<thead>
<tr>
<th></th>
<th>Lower salt</th>
<th>Higher salt</th>
<th>Lower salt</th>
<th>Higher salt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CVD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

P = 0.007
P = 0.02

He, 2010

Lives saved with Modest Na+ reduction

Mohan, 2009

Success in Finland

Sodium | Blood Pressure | Mortality
Mohan, 2009; Karppanen, 2006
Sodium and Renal Disease

- High sodium intake promotes hyperalbuminuria; 50% reduction in salt intake in AA w/ HTN significantly reduced urinary protein and sodium

Why concern regarding salt/sodium?

- Common exposure
  - A teaspoon of table salt = 6 g of salt
    - 1200 mg sodium = 3.0 gm salt
    - 2400 mg sodium = 6.0 gm salt
  - Salt is 40% sodium and 60% chloride
- Modifiable exposure

Salt and BP reduction in select intervention trials

<table>
<thead>
<tr>
<th>Study</th>
<th># of Subjects</th>
<th>Salt intake</th>
<th>SBP</th>
<th>DBP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutler, 1991</td>
<td>873</td>
<td>4.5 g/d</td>
<td>-4.9 [-6.2 to -3.6]</td>
<td>-2.6 [-3.4 to -1.8]</td>
</tr>
<tr>
<td>Midgley, 1996</td>
<td>1131</td>
<td>5.6-7.3 g/d</td>
<td>-3.7 [-5.1 to -2.4]</td>
<td>-0.9 [-1.9 to -0.1]</td>
</tr>
<tr>
<td>Cutler, 1997</td>
<td>1043</td>
<td>6.5 g/d</td>
<td>-4.9 [-5.8 to -3.8]</td>
<td>-2.5 [-3.2 to -1.8]</td>
</tr>
<tr>
<td>Graudal, 1998</td>
<td>2361</td>
<td>6.9 g/d</td>
<td>-3.5 [-4.8 to -2.2]</td>
<td>-1.9 [-2.5 to -1.3]</td>
</tr>
<tr>
<td>He and MacGregor, 2002</td>
<td>734</td>
<td>6.6 g/d</td>
<td>-5.0 [-5.8 to -4.2]</td>
<td>-2.7 [-3.2 to -2.3]</td>
</tr>
<tr>
<td>Hooper, 2002</td>
<td>1188</td>
<td>2.0-2.4 g/d</td>
<td>-1.5 [-3.0 to -1.0]</td>
<td>-7.0 [-12.5 to -1.5]</td>
</tr>
</tbody>
</table>

Results presented for hypertensive subjects

National Advisory Committee Recommendations

- Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure, 2003
- National High Blood Pressure Education Program
  - Lifestyle modification
    - Weight loss
    - Adopt DASH eating plan
    - Dietary sodium restriction
  - Physical activity
  - Moderation of alcohol consumption
- Currently being updated
**DASH Diet Intervention Trial**

*Harsha, 1999*

---

**Dietary Approaches to Stop Hypertension RESULTS**

*Mohan, 2009*

---

**Results: DASH**

![Graph showing cumulative blood pressure changes for DASH diet intervention over weeks.](image)


---

**Cumulative Incidence of CVD: Results of the TOHP I,II Trial**

*Hwang, 2010*

---

Cynthia Thomson, PhD, RD, Sodium and Health
How Many Ways Can You Say....

- Avoid too much sodium
- Use salt and sodium only in moderation
- Choose a diet moderate in salt and sodium
- Choose and prepare foods with less salt
- Choose and prepare foods with little salt. At the same time, consume potassium-rich foods, such as fruits and vegetables.

2005 Dietary Guidelines: Sodium Recommendation

- Consume less than 2,300 mg/day (approximately 1 teaspoon of salt)
- Average American intake is 3400mg/day
- Consider: 75% of our current intake comes from processed foods

2010 IOM Report

- IOM urges a lowering of the and recommended intake of sodium to <1500mg/day for the general population
- Any intake >1500 is associated with significant rise if HTN rates
- Efforts to reduce sodium intake have been unsuccessful
- In recommendations suggest that lowering the recommended intake to <1500 will convince food manufacturers to reduce sodium in the food supply

Estimated Intakes

[Graph showing estimated daily sodium intake by age and gender group]

Cynthia Thomson, PhD, RD, Sodium and Health
### 2010 Dietary Guidelines

<table>
<thead>
<tr>
<th>&lt; 2300mg/day Sodium</th>
<th>&lt; 1500 mg/day Sodium</th>
</tr>
</thead>
<tbody>
<tr>
<td>• General recommendation</td>
<td>• Adults over age 50</td>
</tr>
<tr>
<td>• Applies to about half of the US population</td>
<td>• African-Americans of any age</td>
</tr>
<tr>
<td></td>
<td>• Anyone with a history of:</td>
</tr>
<tr>
<td></td>
<td>- Diabetes</td>
</tr>
<tr>
<td></td>
<td>- Hypertension</td>
</tr>
<tr>
<td></td>
<td>- Chronic kidney disease</td>
</tr>
</tbody>
</table>

### ADA Supports New Recommendations

- ADA advice on how to meet the recommendations include:
  - Decrease salt use in food preparation, for example, omit salt while cooking pasta, rice, etc.
  - Taste before salting, and salt only as needed
  - Eat fresh fruits and vegetables
  - While cooking, use herbs, spice mixes, and juice instead of salt
  - Check food labels for ‘low sodium’, ‘sodium free’, etc.
  - Choose whole foods, which are lower in sodium

### AHA Supports New Recommendations

- AHA advice on how to meet the recommendations include:
  - Choose foods without added salts
  - Choose unsalted nuts, seeds, dried legumes
  - Limit salty snacks like chips and pretzels
  - Avoid adding salt and canned veggies to homemade dishes
  - Choose unsalted and low sodium broths, bouillons, and soups
  - Learn to use herbs, spices, and lemon juice to add flavor

### IOM Recommendations to Achieve Guidelines

- FDA should set national standards for sodium content of food
- Food industry should act voluntarily to decrease sodium in foods prior to mandatory standards
- Government agencies should support the reduction of sodium in the food supply
- Government should support consumers in reducing sodium intake
- Federal agencies should monitor sodium content of foods

Henney, IOM Book: Strategies to reduce sodium intake in the US
Implementation of Recommendations?

- IOM has identified strategies for change
- Population has not met previous recommendations, so setting lower recommendations will likely have little effect on the average person
- Federal agencies and food manufacturers need to move toward the Recommendations, but change has been slow

How to Read Labels

- Sodium Free = < 5mg/serving
- Very Low Sodium = < 35mg/serving
- Low Sodium = < 140mg/serving
- Reduced Sodium = 25% less than ‘regular’
- Unsalted, no salt added, without salt = made without salt, but still contains sodium found naturally in the food
- A “Healthy” labeled food can have no more than 480mg/serving

Are we missing the big picture?

- Sodium is one piece of the puzzle
- Physical Activity
- Obesity
- Other minerals
  - Potassium
  - Calcium
  - Magnesium
- Alcohol

Physical Activity Mitigates the BP Elevating Effects of Sodium

- ~1900 Chinese adults with stage I HTN
  - mean age = 38 years
- Prescribed 3,000 mg Na diet for 7 d, followed by 18,000 mg Na for 7 d
  - If BP rose 5% or more between the two weeks, the ppts were considered to be salt sensitive
- Those with the highest levels of PA had a 38% lower risk of being salt sensitive as compared to those who were least active

Presented at AHA March 2011 Scientific Sessions: Nutrition, PA and Metabolic/CV Disease Epidemiology and Prevention
2010 Canadian Hypertension Education Program

- Restrict sodium
- 30 to 60 minutes moderate aerobic exercise 4-7x/week
- Maintain a healthy body weight and waist circumference
- Alcohol < 14 or 9 drinks/wk for males and females respectively
- Emphasize fruits, vegetables and low fat dairy
- Stress management

World Action on Salt and Health

- WHO alliance of nations- < 5 gm/day
- Identified significant variance in sodium content of identical foods manufactured and sold internationally
- Commitments from: Kellogg, Pepsico, Unilever, Heinz, Campbell’s and Kraft

WASH Members (Red Dots)

Sodium and Health

- Clear association with HTN, CVD, Stroke, renal disease
- Intake > requirements
- "Hidden" sources make informed avoidance difficult
  - Fresh when possible
  - Read labels
  - Promote responsible action by food manufacturers
- DASH eating plan
  - NHLBI, AHA, Dietary Guidelines, MyPyramid, etc