SODIUM- how much?...

Elizabeth C. Gath, MD
Associate Professor Medicine
UAMS
Oct 2016
Intracellular fluid
40% of total body weight

Total body fluid
60% of total body weight

Plasma
5% of total body weight

Interstitial and transcellular fluid
15% of total body weight

Extracellular fluid
20% of total body weight
Interstitial fluid

K⁺ binding site

Sodium-potassium pump

Na⁺ - binding site

ATP

Intracellular fluid
Evolution of Disease; 10–50 yrs

CVD Risk

Number of Drugs

Treatment Guidelines

Clinical Trials

Younger

Hypertension:
- Lipid Disorder
- Glucose Disorder
- BP dysregulation
- No TOD
- No CVD

Target Organ Damage:
- LVH
- Vascular Structural Damage
- Systolic Hypertension
- LV Dysfunction
- Small Vessel Brain Disease
- Albuminuria/Declining GFR

Drug Treatment

Surrogate End-points

Hard End-points

Metabolic syndrome to diabetes

Older

Cardiovascular Disease:
- CHD/CHF
- Stroke/TIA
- Dementia
- Renal Disease
- Macular degeneration
- Death
HOW MUCH Salt DO WE CONSUME?

• AVERAGE AMERICAN: 3-6gm per day
  – Characterized by higher intake
    • red meats and processed meats
    • refined grains
    • sweets and desserts
    • French fries
    • high calorie products
American Food Supply

- Patterns of food supply, distribution, preparation and consumption have undergone a marked change in the past 100 years:
  - Prior to the 20th Century, most Americans ate meals that they prepared at home, for themselves
  - Today, a significant number of meals are eaten outside the home and even if eaten at home, they are prepared elsewhere
RATE OF HTN BY COUNTRY
SODIUM EQUIVALENTS

- 1 gm Na+ = 44 meq Na+
- 1 gm NaCl = 17 meq Na+
- 2.3 gm NaCl = 6 gm Na+ = 102 meq Na+
- 3.5 gm NaCl = 9 gm Na+
Outcomes in observational studies linking sodium intake to morbidity and mortality.

23 Studies
Subjects > 360,000
End points > 26,000

- J-shaped
  - N = 2
  - Refs: 37,40

- Inverse
  - N = 6
  - Refs: 20,22,28,32,36,39

- Direct
  - N = 7
  - Refs: 19,24,25,26,27,31,35

- No or mixed
  - N = 8
  - Refs: 18,21,23,29,30,33,34,38

Michael H. Alderman, and Hillel W. Cohen Am J Hypertens
2012;25:727-734

© 2012 by the American Journal of Hypertension, Ltd.
SALT SENSITIVITY?

• THE EXTENT OF BP CHANGE AFTER ABRUPT CHANGES IN SALT INTAKE
• INCREASES WITH AGE
• OBESITY, METABOLIC SYNDROME, CRD, AFRICAN AMERICANS
TOMHS

• Treatment of Mild Hypertensive Study
• Pts who remained on lifestyle program had average 8.6mm fall in BP
• Lifestyle modifications difficult to maintain

• 1993 JAMA
BENEFITS OF DECREASED SODIUM

- IMPROVED BLOOD PRESSURE
- DECREASE PROTEINURIA (PTS RECEIVING ACE)
- LOWERS URINARY CALCIUM EXCRETION
- REGRESSION OF LVH
DASH STUDIES

Dietary Approaches to Stop Hypertension

• EMPHASIZES FRUITS, VEGETABLES, WHOLE GRAINS, POULTRY, FISH AND NUTS
• DECREASED BP WITH STAGE 1 HTN and in NORMOTENSIVE INDIVIDUALS
• Also decreased TC, LDL, HDL
• DASH REDUCED BP
  – 7.1mm in normotensive
  – 11.5mm in hypertensive
CORONARY HEART DISEASE MODEL
– if pop reduced Na+ by ~3gm/day

• DECREASE CHD BY 120,000
• DECREASE CVA BY 66,000
• DECREASE MI BY 99,000
• DECREASE DEATH ALL CAUSES 92,000
• INCREASE HEALTH CARE SAVINGS $24 B

» ANNUALLY
MAJOR SOCIETY RECOMMENDATIONS

• US DEPT AGRICULTURE
• HEALTH & HUMAN SERVICES
• 7th JOINT NATIONAL COMMISION
  – < 2.3gm Na or 100 meq Na
• EUROPEAN SOCIETY HYPERTENSION
  – < 6gm NaCl
SODIUM EQUIVALENTS

- 1 gm Na+ = 44 meq Na+

- 1 gm NaCl = 17 meq Na+

- 2.3 gm NaCl = 6 gm Na+ = 102 meq Na+
• 1B – REDUCE DIETARY Na+ TO <100 MEQ/DAY FOR HTN PATIENTS
• 2B – AS ABOVE BUT FOR ENTIRE POPULATION

• GOAL – REDUCE OR PREVENT HTN
  – REDUCE RISK CV EVENT
Other associations with high salt intake independent of blood pressure

<table>
<thead>
<tr>
<th>Renal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hyperfiltration</td>
</tr>
<tr>
<td>Reduced effect of calcium channel blockers and ACE inhibitors on proteinuria</td>
</tr>
<tr>
<td>Increased calcium excretion</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cardiac</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left ventricular hypertrophy</td>
</tr>
<tr>
<td>Increased heart rate</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Metabolic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulin resistance</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cancer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stomach cancer</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Respiratory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asthma</td>
</tr>
</tbody>
</table>
WHERE IS SALT?

• EVERYWHERE

• 80% DIETARY SALT IS ADDED TO FOODS DURING PROCESSING
YOU ARE WHAT YOU EAT
DIETARY RECOMMENDATIONS

• DAILY INTAKE FRUITS & VEGETABLES (9)
• LIMIT INTAKE DAIRY AND MEAT
• REGULAR INTAKE OF FISH (1-2X PER WEEK) OR PLANT SOURCES alpha linolenic
• WHOLE GRAINS
• USE OF VEGETABLE OILS IN MODERATION
• SODIUM INTAKE 4-6 gm per day (1.5-2.3gm NaCl)
Use healthy oils (like olive and canola oil) for cooking, on salad, and at the table. Limit butter. Avoid trans fat.

The more veggies – and the greater the variety – the better. Potatoes and French fries don’t count.

Eat plenty of fruits of all colors.

DRINK WATER, TEA, OR COFFEE (with little or no sugar). Limit milk/dairy (1-2 servings/day) and juice (1 small glass/day). Avoid sugary drinks.

Eat a variety of whole grains (like whole-wheat bread, whole-grain pasta, and brown rice). Limit refined grains (like white rice and white bread).

Choose fish, poultry, beans, and nuts; limit red meat and cheese; avoid bacon, cold cuts, and other processed meats.

STAY ACTIVE!

© Harvard University

Harvard T.H. Chan School of Public Health
The Nutrition Source
www.hsph.harvard.edu/nutritionsource

Harvard Medical School
Harvard Health Publications
www.health.harvard.edu
IMPLICATIONS FOR POLICY

• COMMUNITY EDUCATION
  – Home, school, workplace
• REGULATORY MEASURES
  – Trans fats, sugar, salt
• FOOD INDUSTRY
  – PRODUCTION, PROCESSING, PRICE
Avoid the Salt
Savor the Flavors!
• “Let food be thy medicine, and medicine be thy food.”

• “The wise consider health to be the greatest of human blessings.”

• -Hippocrates