Estimating Sodium & Potassium Intakes and their Ratio in the American Diet

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Conflicts of Interest/Disclosures

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*The opinions expressed here are my own and not a reflection of the NIH, the federal government, or Purdue University*
SODIUM: Intakes and Limits

Average Intake of Sodium in Milligrams per Day by Age-Sex Groups Compared to Tolerable Upper Intake Levels

Data Sources:
What We Eat in America, NHANES 2007-2010 for average intakes by age-sex group. Institute of Medicine Dietary Reference Intakes for Tolerable Upper Intake Levels (UL).
OVERVIEW

• Na & K are two minerals that have consistently remained as nutrients of concern in the American diet\(^1\)

\(^1\) Dietary Guidelines for Americans
### WHAT YOU NEED TO KNOW:

<table>
<thead>
<tr>
<th></th>
<th>WHO</th>
<th>U.S. DRI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Na</td>
<td>&lt; 2000 mg/day</td>
<td>&lt; 2300 mg/day</td>
</tr>
<tr>
<td>K</td>
<td>3510 mg/day</td>
<td>4700 mg/day</td>
</tr>
<tr>
<td>Na:K</td>
<td>&lt; 0.57</td>
<td>&lt;0.49</td>
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</tbody>
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*Food and Nutrition Board.*

*Dietary reference intakes for Water, Potassium, Sodium, Chloride, and Sulfate; 2005.*

Sodium in the context of Potassium

- Dietary sodium to potassium **ratio** (Na:K) is more strongly associated with an increased risk of CVD–related mortality

STUDY AIMS

• To estimate sodium and potassium intakes and the Na:K ratio in the diet of U.S. adults
  ▪ Mean estimates
  ▪ Energy-adjusted (per 1,000 kcal)

• To determine the percentage (%) of individuals who meet the recommended dietary Na:K ratio target of <1.0
  ▪ Race/ethnicity, age, sex
  ▪ Examine food sources

National Health and Nutrition Examination Survey (NHANES)

• To assess the health and nutritional status of adults and children in the United States
NHANES Dietary Data

• n=4,730 adults >20 years
  - USDA’s Automated Multiple-Pass Method
    ✓ Two 24-hour dietary recalls
  - USDA Food and Nutrient Database for Dietary Studies was used to convert foods & beverages to accurate gram equivalents
METHODS: REDUCE RANDOM ERROR

- National Cancer Institute (NCI) Method
  - Adjusted within-person variability to estimate usual intake distributions
MEAN ENERGY, SODIUM & POTASSIUM

U.S. Adults

- Energy
- Sodium
- Potassium
SODIUM & POTASSIUM INTAKES
U.S. Adults, Age 20 y. & older, by Race/Ethnicity
KEY FINDINGS:

• Within sex, intakes of sodium decreased and potassium increased with age

• Asian men and women had the highest sodium intakes

• Men
  ✓ White and Asian males had higher potassium intakes than Blacks or Hispanics

• Women
  ✓ Black women had lower potassium than all other race/ethnic groups
KEY FINDINGS

• 90% of adults FAIL to meet the sodium targets

• <3% of adults MEET the potassium targets
Na:K Ratio
U.S. Adults, Age 20 y. & older, by Sex & Age

* All age group differences were statistically significant
Na:K Ratio
U.S. Adults, Age 20 y. & older, by Sex & Age

Na:K

Na:K < 1.0, %

* All age group differences were statistically significant
Na:K Ratio
U.S. Adults, Age 20 y. & older, by Race/Ethnicity

- **White**: 1.34
- **Black**: 1.54
- **Hispanic**: 1.49
- **Asian**: 1.38
Na:K Ratio
U.S. Adults, Age 20 y. & older, by Sex & Age

Na:K < 1.0, %

- White: 23% (23% Men, 23% Women)
- Black: 2% (1% Men, 2% Women)
- Hispanic: 11% (6% Men, 11% Women)
- Asian: 10% (8% Men, 10% Women)
KEY FINDINGS: Na:K RATIO

• Overall 12% of U.S. adults have the Na:K associated with CVD protection
  ▪ Women (18%) > Men (7%)
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• Overall 12% of U.S. adults have the Na:K associated with CVD protection
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• Non-Hispanic White adults make up the largest percentage of the population (16%) who meet the Na:K <1.0 dietary target
FOOD SOURCES OF SODIUM
Food Category Sources of Sodium in the US Population Ages 2 Years and Older

Data Source:
What We Eat in America (WWEIA)
Food Category analyses for the 2015 Dietary Guidelines Advisory Committee. Estimates based on day 1 dietary recalls from WWEIA, NHANES 2009-2010.
FOOD SOURCES of % CONTRIBUTION TO SODIUM

- Mixed dishes: 37% (> 1)
- Protein food: 24% (> 1)
- Grains: 22% (> 1)
- Snacks and Sweets: 15% (> 1)
- Vegetables: 9% (< 1)
- Milk and dairy: 8% (< 1)

Graph showing contribution of various food sources to sodium intake.
FOOD SOURCES of % CONTRIBUTION TO POTASSIUM

- Beverages: <1
- Mixed Dishes: 23
- Protein: 19
- Vegetables: 15
- Milk and Dairy: 16

Values: 20 13 19 18 16 15 13 12 8
OVERALL, WHAT’S THE DIFFERENCE??

- **Mixed Dishes**: Na:K < 1.0 (60%) vs. Na:K ≥ 1.0 (80%)
- **Condiments**: Na:K < 1.0 (40%) vs. Na:K ≥ 1.0 (50%)
- **Vegetables**: Na:K < 1.0 (70%) vs. Na:K ≥ 1.0 (70%)
- **Milk and Dairy**: Na:K < 1.0 (60%) vs. Na:K ≥ 1.0 (60%)
- **Fruit**: Na:K < 1.0 (40%) vs. Na:K ≥ 1.0 (40%)

**Legend**: 
- **Na:K < 1.0**
- **Na:K ≥ 1.0**
WHAT DOES THIS TELL US?

• Individuals with a dietary Na:K ratio of <1.0 when compared to those with a dietary Na:K ≥ 1.0 were:
  
  • Less likely to consume:
    • Mixed dishes
    • Condiments
  
  • More likely to consume:
    • Vegetables
    • Milk & dairy products
    • Fruit

A dietary pattern that is lower in sodium and higher in potassium aligns with other recommendations for heart health.
STUDY STRENGTHS & LIMITATIONS

• Only current data available on Non-Hispanic Asian Americans

• Does not include discretionary salt use
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• Measurement Error associated with Self-Report Data
  ▪ Within-person variation
    • Easily adjusted with repeat applications and modeling
  ▪ Systematic bias
    • Misreporting based on individual characteristics
USDA “AMPM” Method Validated

- Energy Under-reporting
  - Ranged from 3-11%
  - Dependent on weight status
- Sodium
  - 0.93 (95%CI 0.89-0.97) for men
  - 0.90 (95%CI 0.87-0.94) for women


24 HOUR RECALLS: LIMITATIONS

• The OPEN STUDY: Observing Protein and Energy Nutrition

✓ Potassium under-reporting (0-4%)
✓ Sodium under-reporting (4-13%)
✓ Na:K Under-reporting (5-9%)

THE BIG PICTURE

• Continued efforts to reduce sodium in tandem with novel strategies to increase potassium intakes are warranted.

• Increasing potassium-rich food intakes while reducing intake of foods high in sodium would improve the dietary Na:K ratio

  ✓ Mixed dishes and condiments easy targets

• Healthy overall combinations and patterns of foods & nutrients, rather than simply focusing on sodium reduction in isolation is optimal
THANKS A BUNCH!