

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

Regan Bailey PhD, MPH, RD, CPH

Purdue University, Department of Nutrition Science

U.S.A



Conflicts of Interest/Disclosures

Consultant: Nestle, Nutrition Impact LLC, NIH

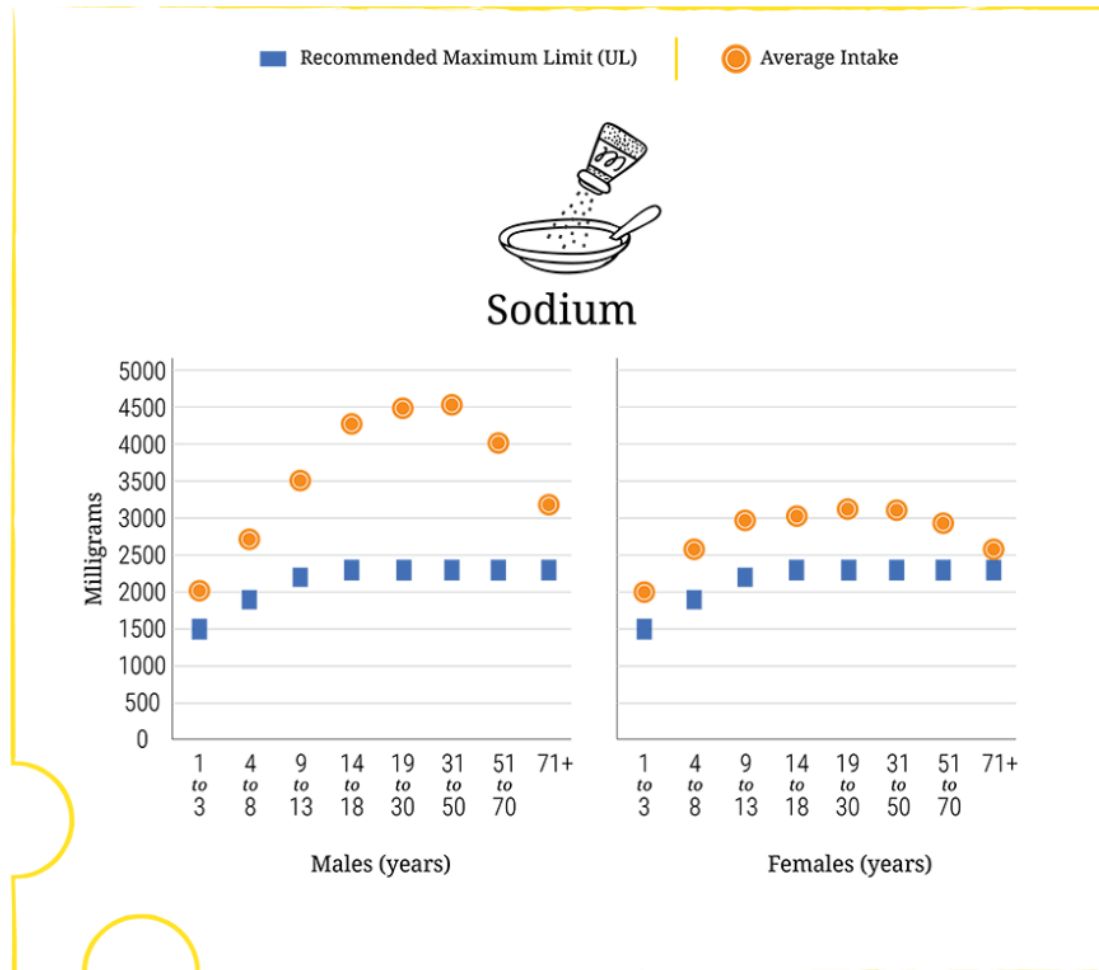
Other: ILSI NA (Scientific Advisor), IFIC (Board of Trustees)

This data presented in this talk were funded by the ILSI Sodium Committee through a cooperative agreement with the USDA.

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 diet¹



¹ Dietary Guidelines for Americans



WHAT YOU NEED TO KNOW:

	WHO	U.S. DRI
Na	< 2000 mg/day	< 2300 mg/day
K	3510 mg/day	4700 mg/day
Na:K	< 0.57	<0.49

World Health Organization. Guidelines: Sodium and Potassium intake for adults and children; 2012. Food and Nutrition Board.

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

Drewnowski A, et al. Reducing the sodium-potassium ratio in the US diet: a challenge for public health. Am J Clin Nutr 2012;96:439-44

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

Dietary Sodium to
Potassium (Na:K)
Ratio



Na:K (Hazard Ratio 95%CI)

AC Mortality: 1.46 (1.27-1.67)
CVD Mortality: 1.92 (1.11-1.92)
IHD Mortality: 2.15 (1.48-3.12)

Yang Q, et al. Sodium and potassium intake and mortality among US adults: prospective data from the Third National Health and Nutrition Examination Survey. Arch Intern Med 2011;171:1183-91.

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

Bailey RL, et al. Estimating Sodium and Potassium Intakes and Their Ratio in the American Diet: Data from the 2011-2012 NHANES. Journal of Nutrition; 2016; 146: 745-750.

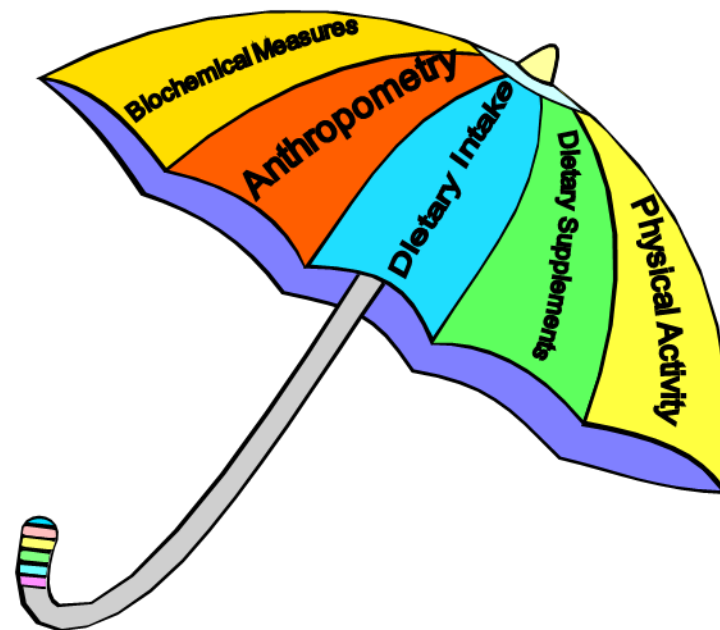
National Health and Nutrition Examination Survey (NHANES)

- To assess the health and nutritional status of adults and children in the United States



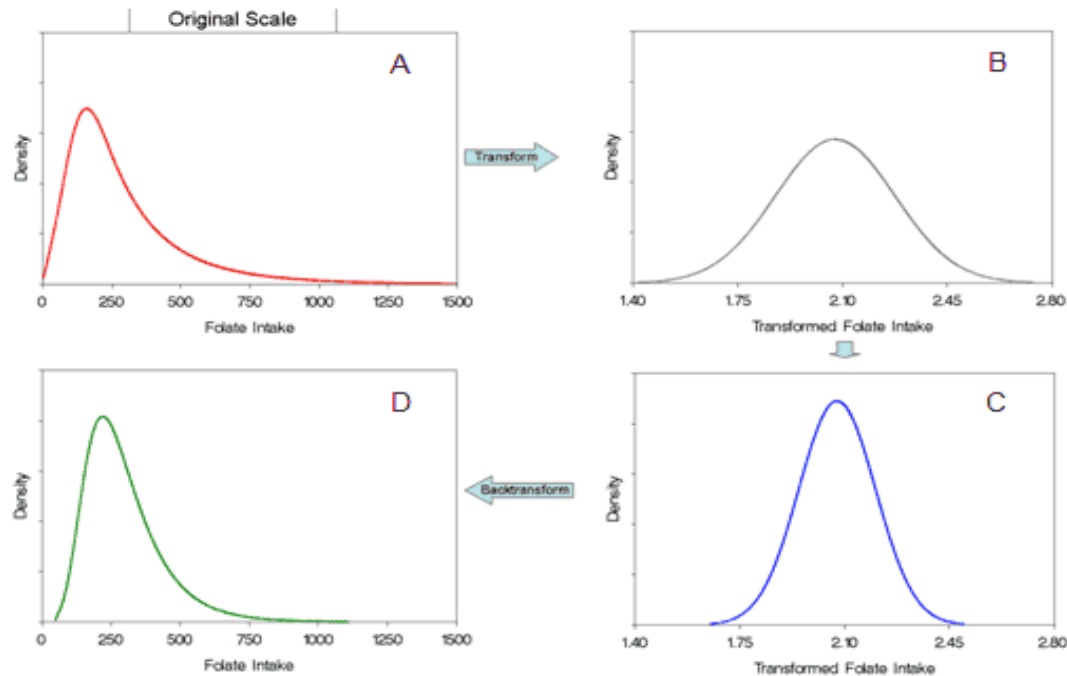
NHANES Dietary Data

- 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

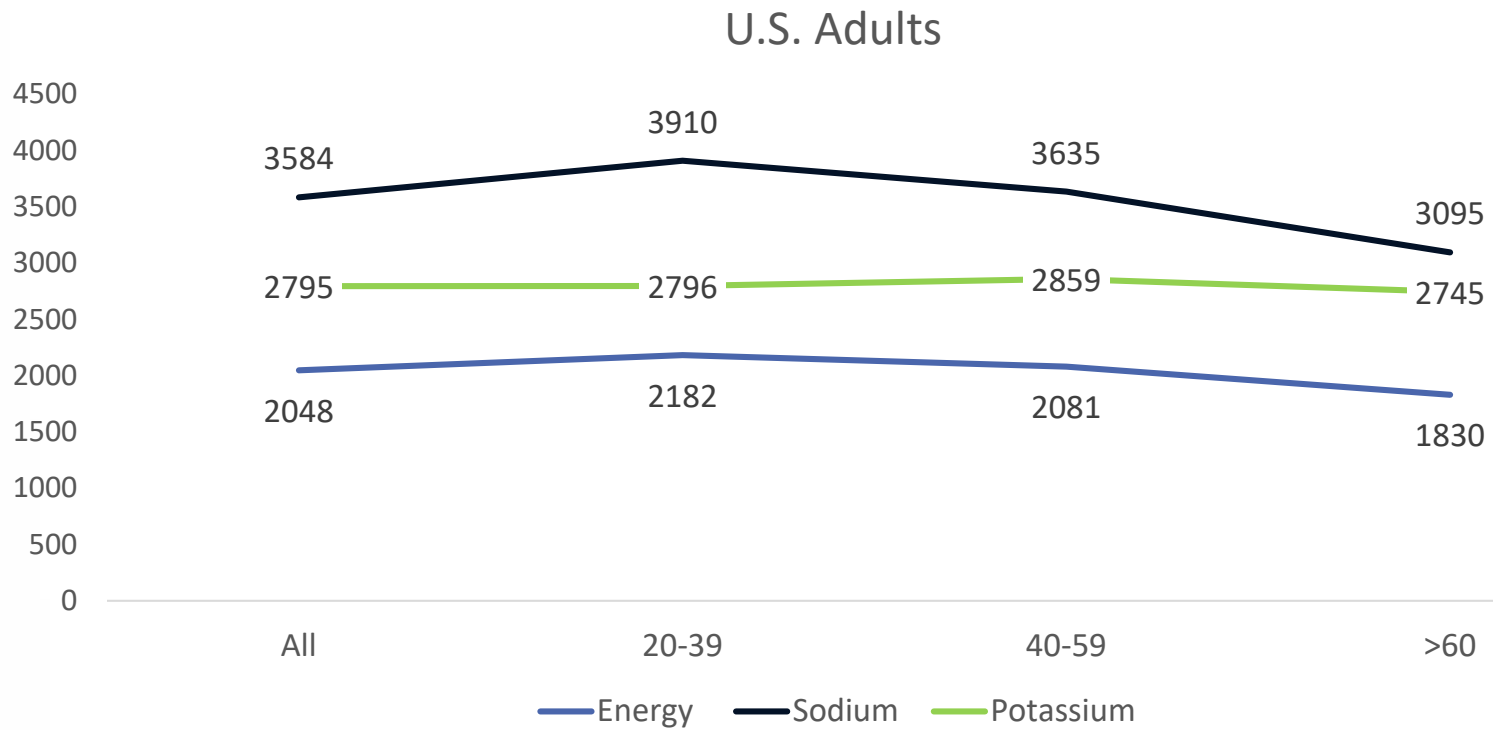


METHODS: REDUCE RANDOM ERROR

- **National Cancer Institute (NCI) Method**
 - Adjusted within-person variability to estimate usual intake distributions

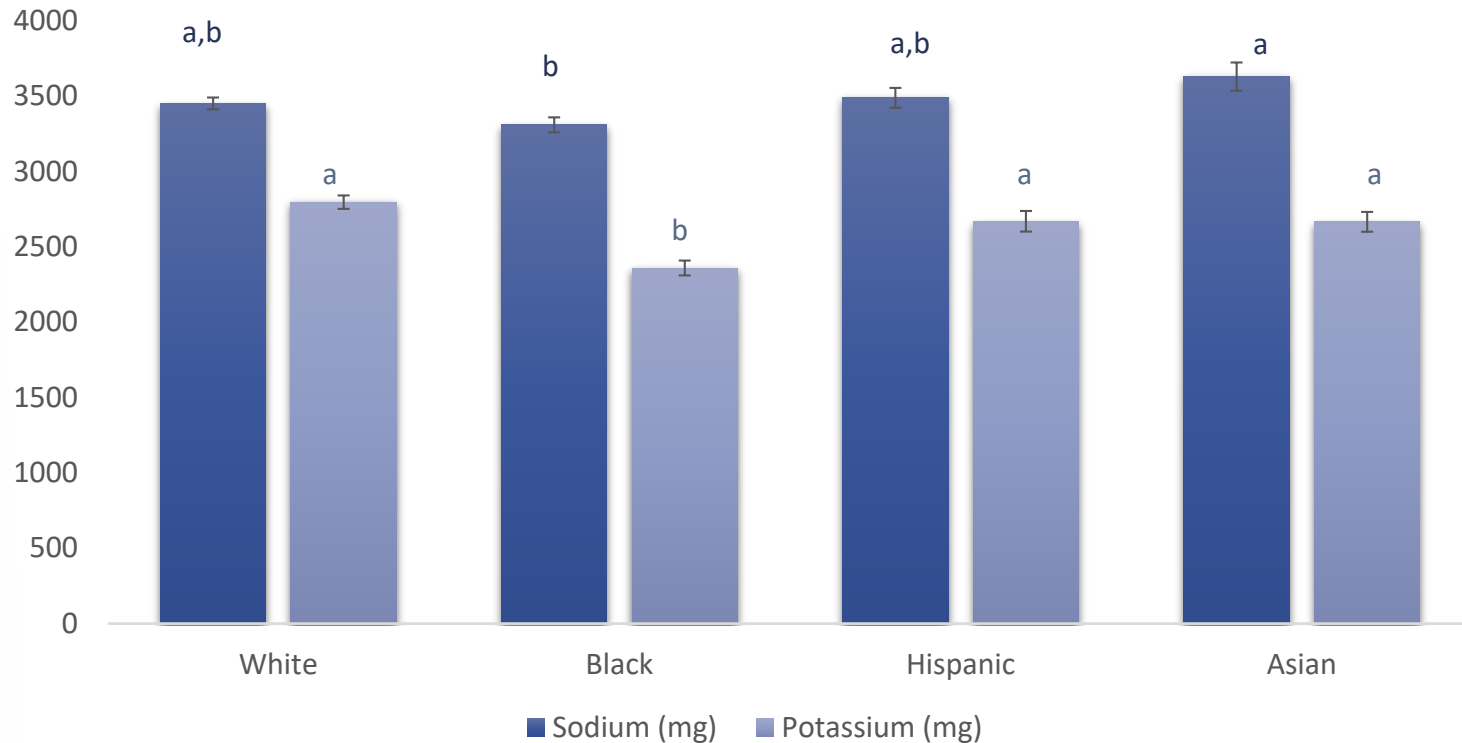


MEAN ENERGY, SODIUM & POTASSIUM



SODIUM & POTASSIUM INTAKES

U.S. Adults, Age 20 y. & older, by Race/Ethnicity



KEY FINDINGS:

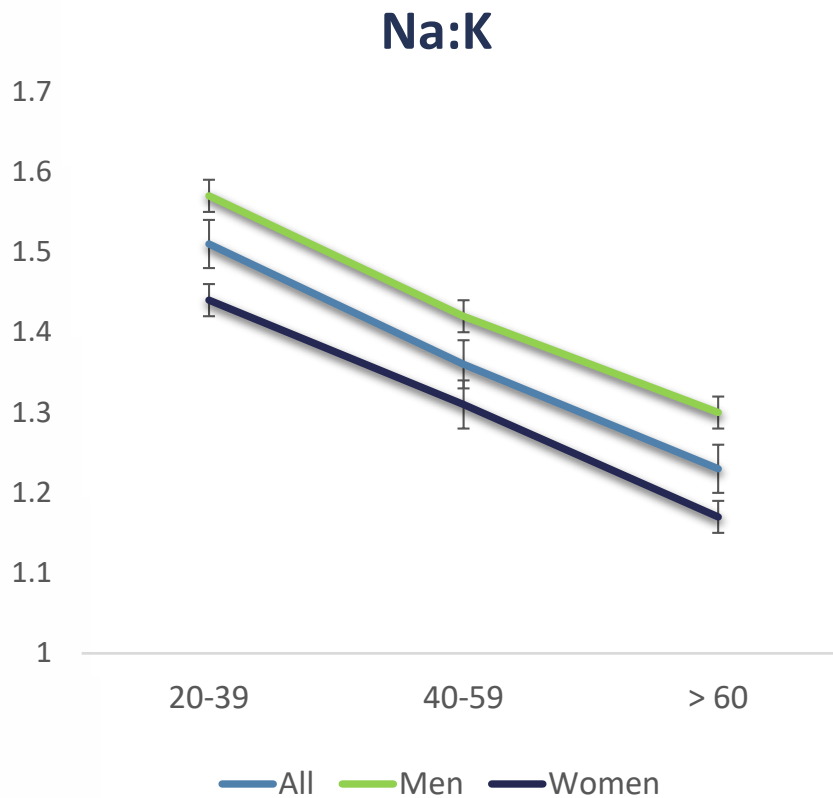
- Within sex, intakes of sodium decreased and potassium increased with age
- Asian men and women had the highest sodium intakes
- Men
 - ✓ White and Asian males had higher potassium intakes than Blacks or Hispanics
- Women
 - ✓ Black women had lower potassium than all other race/ethnic groups

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

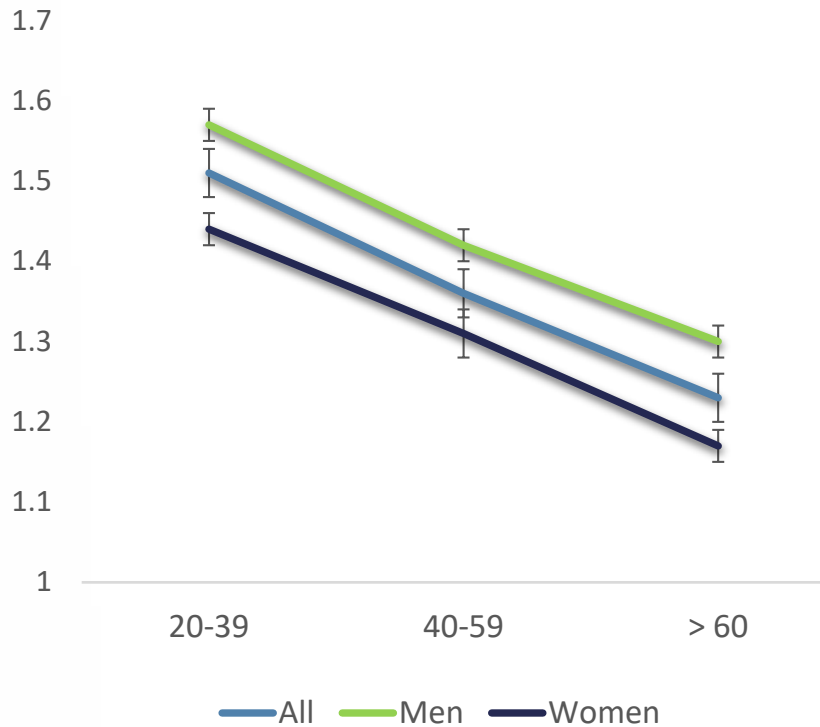


* All age group differences were statistically significant

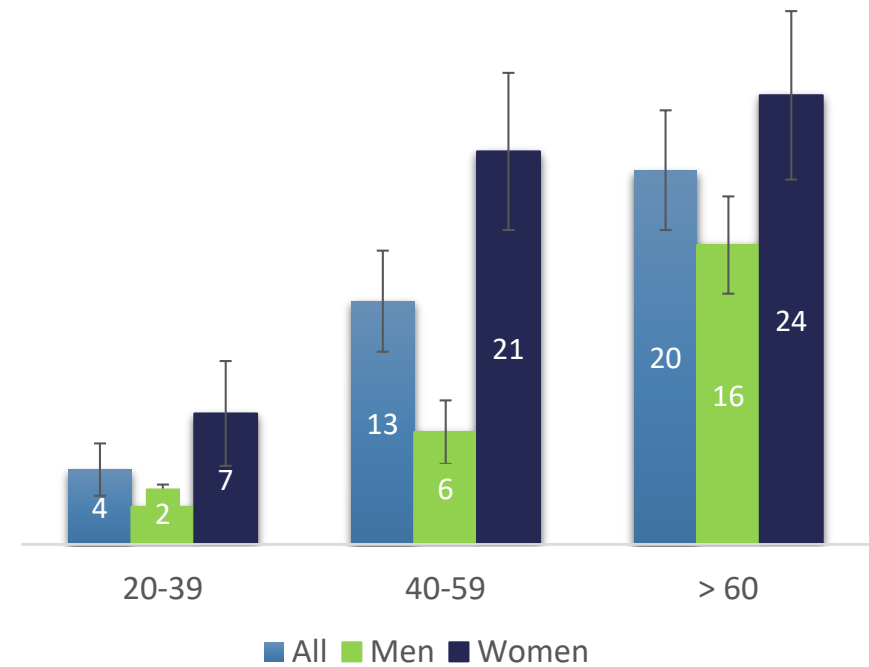
Na:K Ratio

U.S. Adults, Age 20 y. & older, by Sex & Age

Na:K



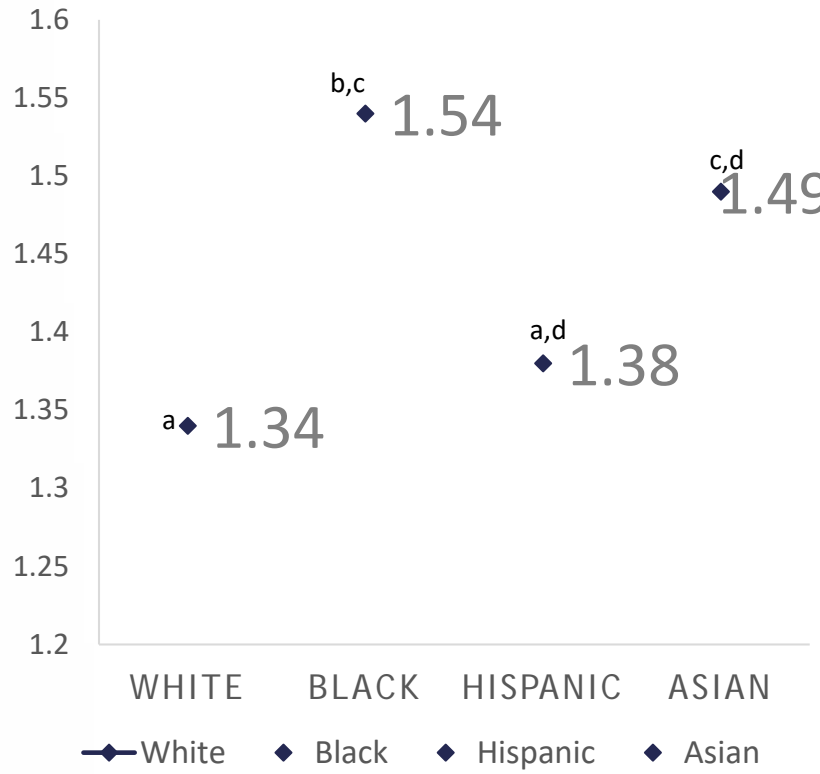
Na:K < 1.0, %



* All age group differences were statistically significant

Na:K Ratio

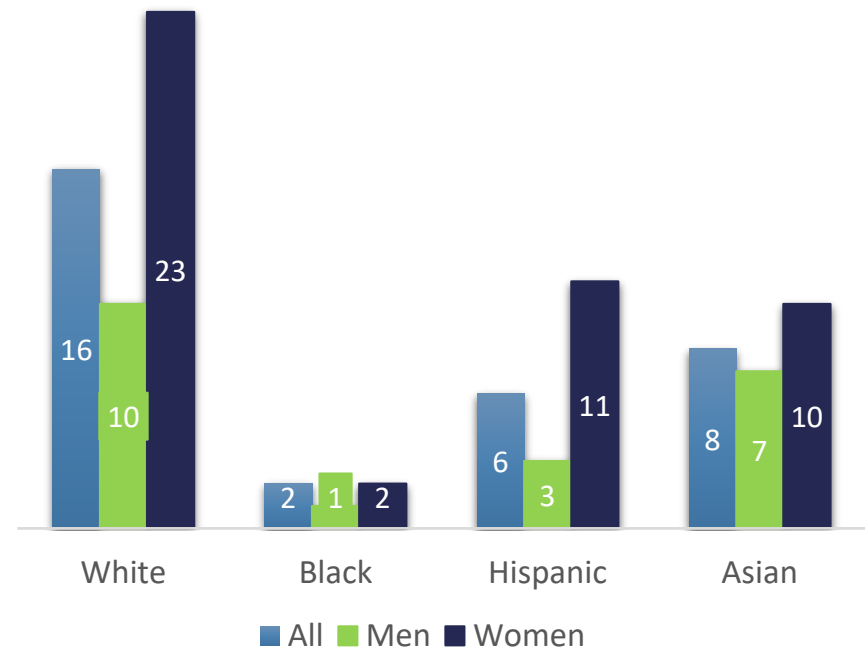
U.S. Adults, Age 20 y. & older, by Race/Ethnicity



Na:K Ratio

U.S. Adults, Age 20 y. & older, by Sex & Age

Na:K < 1.0, %



KEY FINDINGS: Na:K RATIO

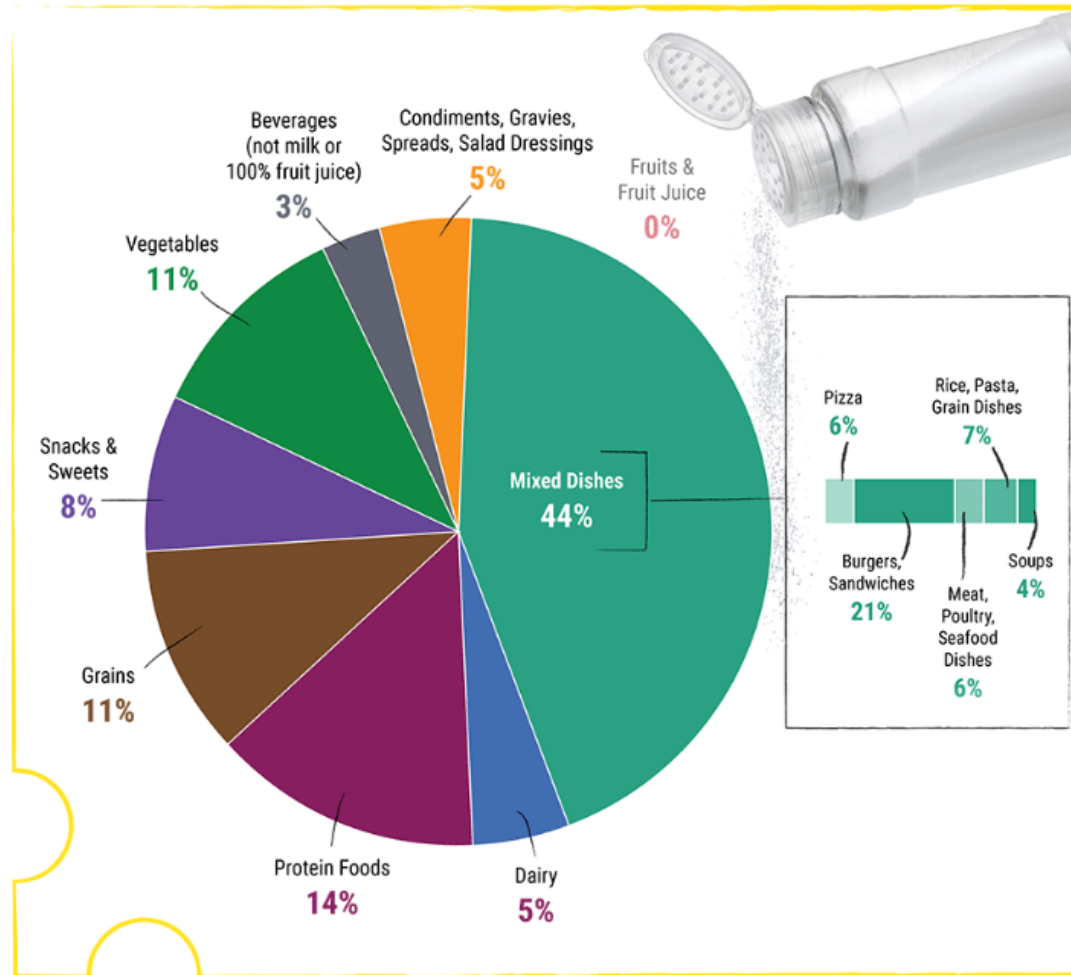
- Overall 12% of U.S. adults have the Na:K associated with CVD protection
 - Women (18%) > Men (7%)

KEY FINDINGS: Na:K RATIO

- Overall 12% of U.S. adults have the Na:K associated with CVD protection
 - Women (18%) > Men (7%)
- Non-Hispanic White adults make up the largest percentage of the population (16%) who meet the Na:K <1.0 dietary target

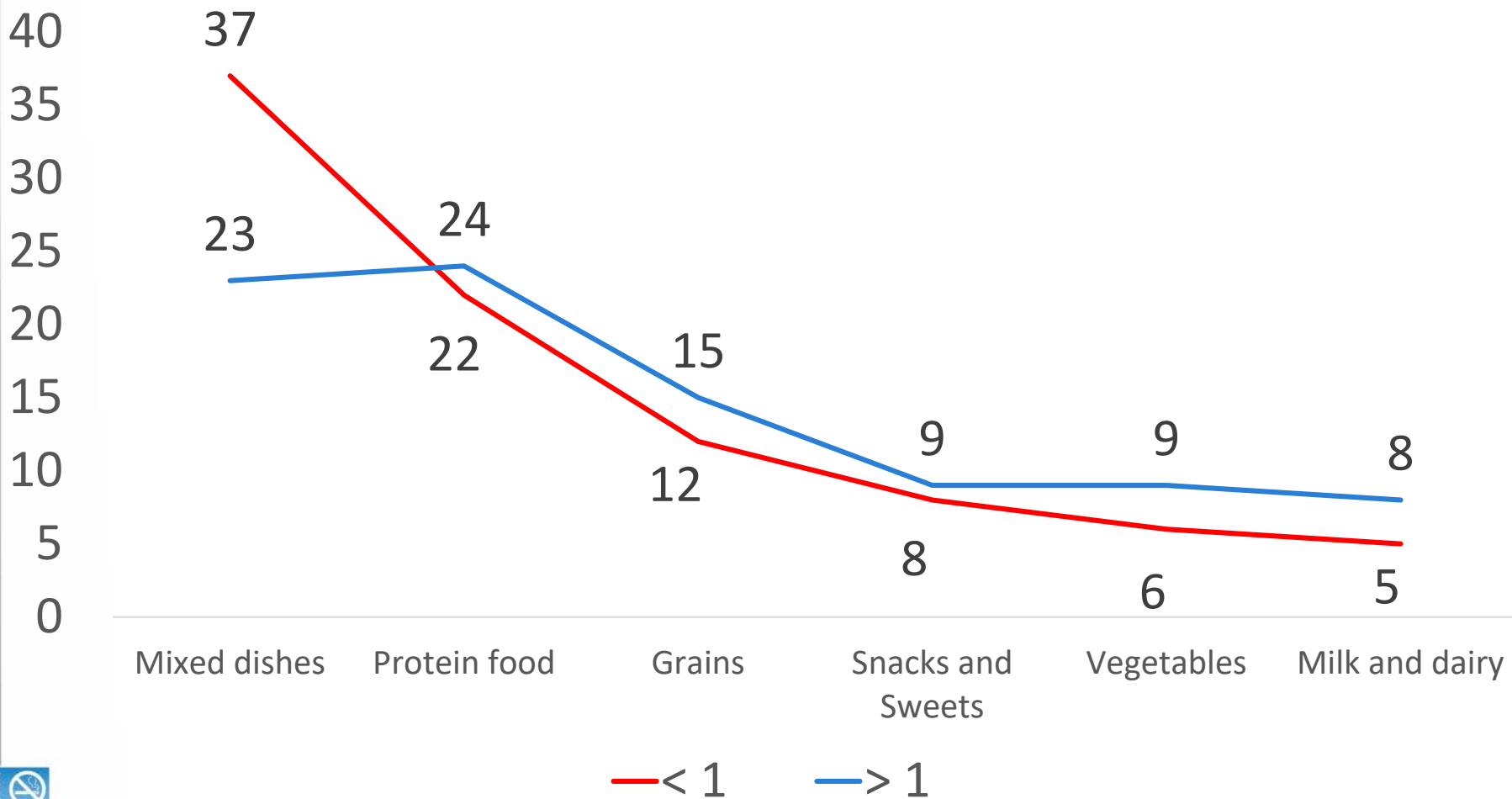
FOOD SOURCES OF SODIUM

Food Category Sources of Sodium in the US Population Ages 2 Years and Older

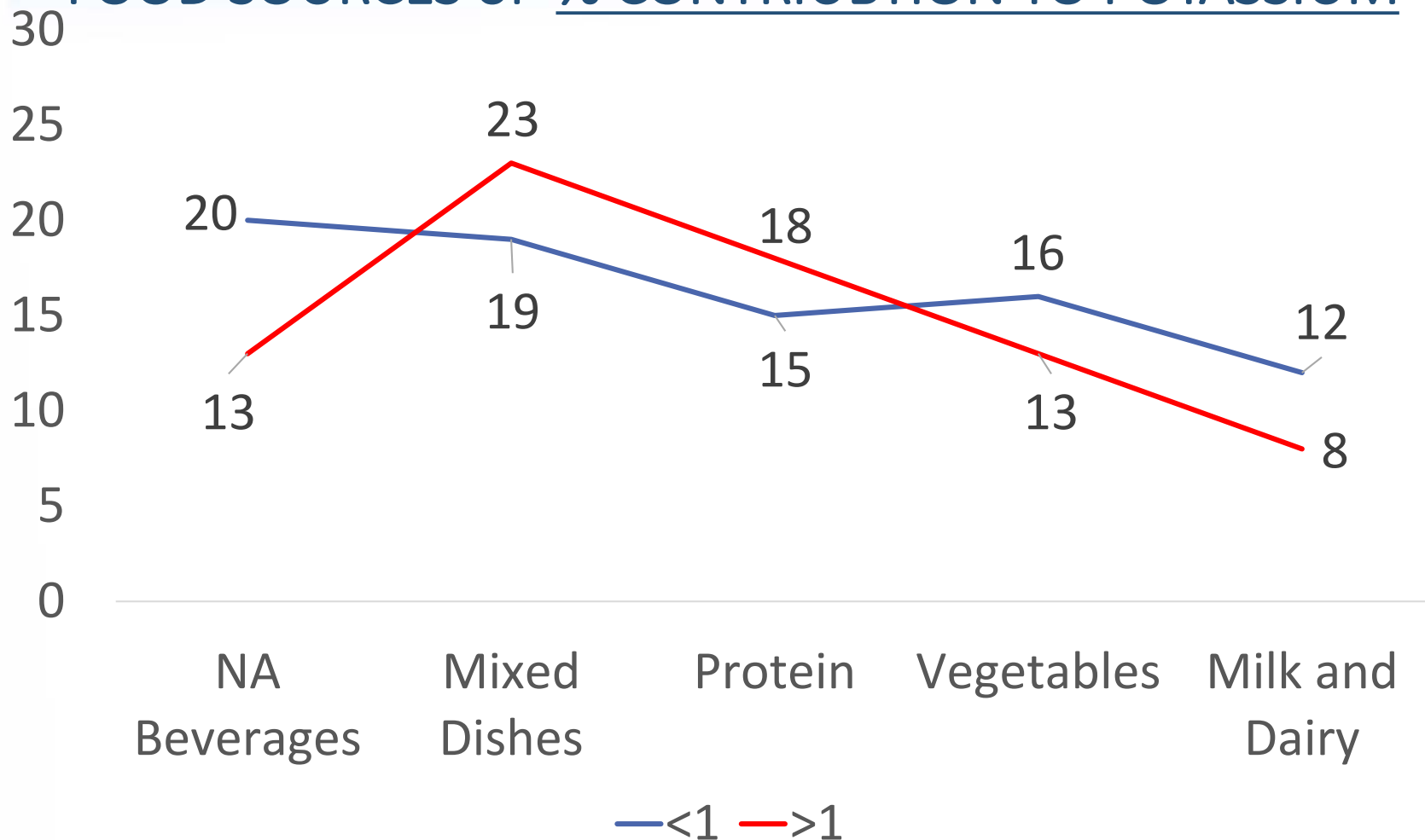


Data Source:
 What We Eat in America (WWEIA)
 Food Category analyses for the 2015
 Dietary Guidelines Advisory
 Committee. Estimates based on day
 1 dietary recalls from WWEIA,
 NHANES 2009-2010.

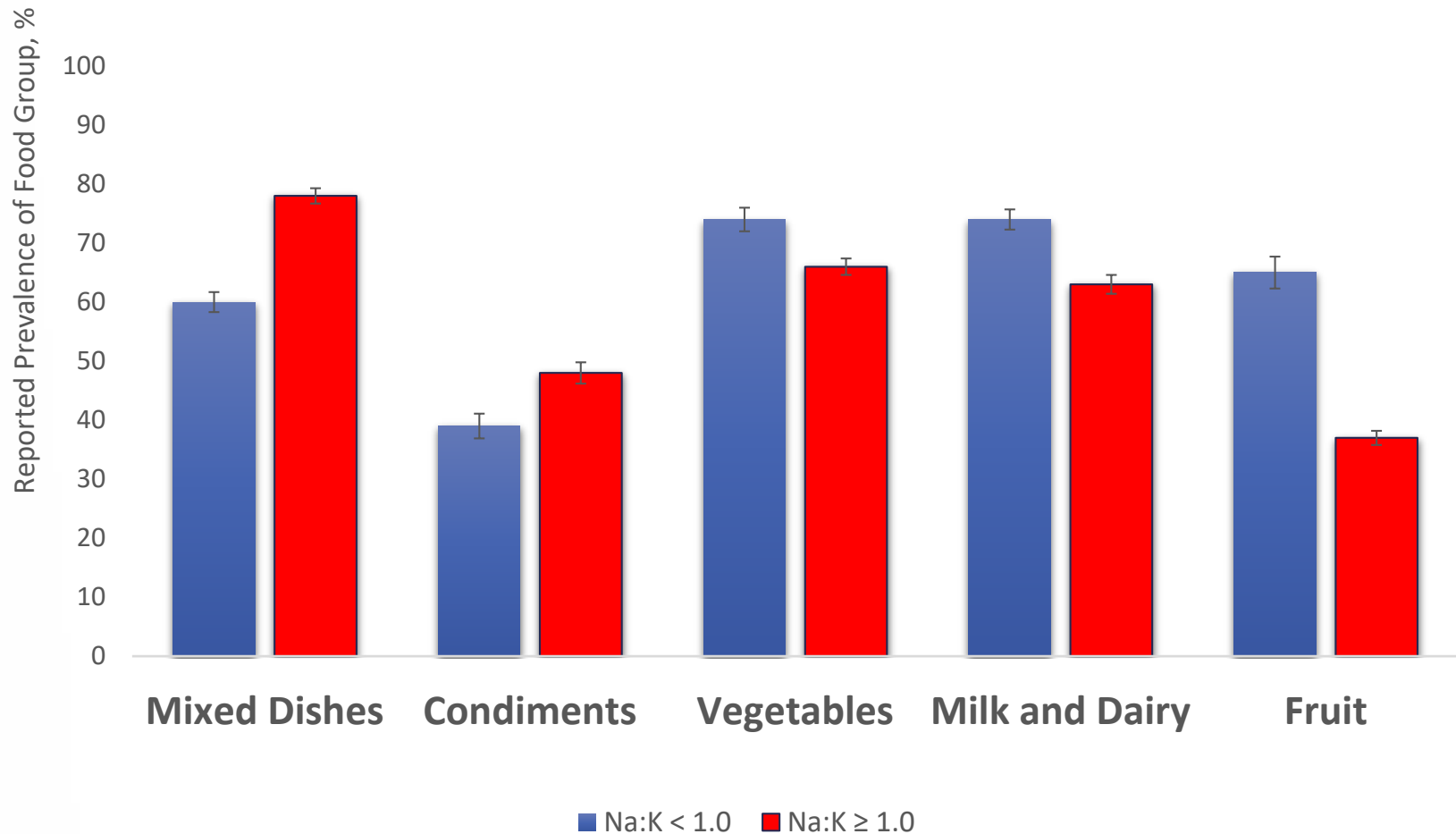
FOOD SOURCES of % CONTRIUBTION TO SODIUM



FOOD SOURCES of % CONTRIUBTION TO POTASSIUM

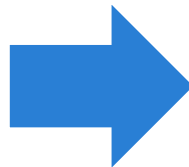


OVERALL, WHAT'S THE DIFFERENCE??



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

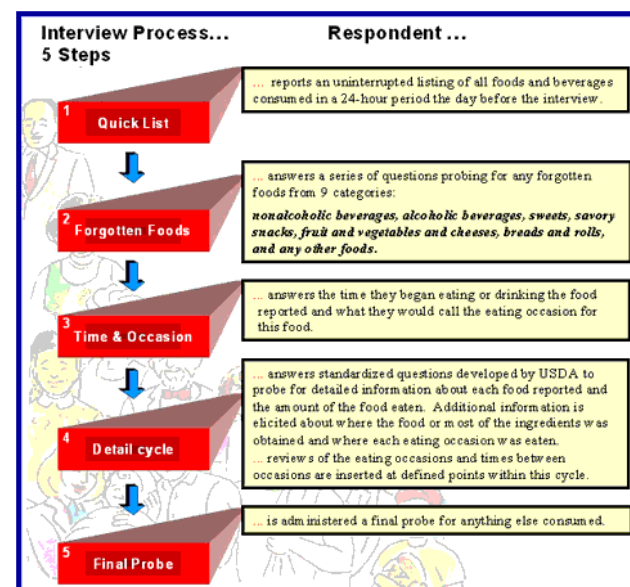
- Only current data available on Non-Hispanic Asian Americans
- Does not include discretionary salt use

STUDY STRENGTHS & LIMITATIONS

- Only current data available on Non-Hispanic Asian Americans
- Does not include discretionary salt use
- 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 (05%CI 0.89-0.97) for men
 - 0.90 (05%CI 0.87-0.94) for women



Moshfegh AJ, et al. The US Department of Agriculture Automated Multiple-Pass Method reduces bias in the collection of energy intakes. *Am J Clin Nutr* 2008;88:324-32.

Rhodes DG, et al. The USDA Automated Multiple-Pass Method accurately assesses population sodium intakes. *Am J Clin Nutr* 2013;97:958-64.

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%)

Freedman LS, et al. Pooled results from 5 validation studies of dietary self-report instruments using recovery biomarkers for potassium and sodium intake. Am J Epidemiol 2015;181:473-87

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

The image features a dense, repeating pattern of stylized yellow bananas on a white background. Each banana is depicted with a simple black outline for its stem and a small black dot for the stem's base. The bananas are scattered across the entire frame, creating a playful and vibrant texture. In the center of the image, the phrase "THANKS A BUNCH!" is written in a bold, black, cursive font. The text is slightly shadowed, giving it a three-dimensional appearance as if it's floating above the banana pattern.

THANKS A BUNCH!