

IOM Strategies to Reduce Sodium Intake Meeting
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ILSI North America

Sources of Sodium in the Food Supply

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Objectives

- To determine sodium and potassium **intakes** from processed and unprocessed foods in the US by age group
 - To determine **dietary sources** of sodium and potassium intake from processed and unprocessed food in the US by age group
- ∇ Analyses conducted by:
- Victor Fulgoni, III, PhD of Nutrition Impact, LLC
 - Debra R. Keast, PhD of Food & Nutrition Database Research, Inc.

Database

- **NHANES, 2003-2004**, n = 8,894 with complete, reliable 24-hour recall interview on Day 1
- **Subjects included:** n = 7,966 aged 2 years and older
- **Subjects excluded:** n = 928
 - Children <2 years: n = 621
 - Pregnant/lactating females: n = 307 (257 pregnant, 43 lactating, 7 both pregnant and lactating)

Foods

- **Food source:** Where food was obtained (e.g., store vs. restaurant or dining hall)
- **Food groups:**
 - Survey foods were classified to food groups in line with those documented by USDA Food Surveys Research Group, and ingredients of survey foods were classified using the same food grouping scheme.
 - Recipes of the USDA Food and Nutrient Database for Dietary Studies (FNDDS) were used to disaggregate mixtures and examine the percentage of total dietary intakes contributed by each food group of ingredients.
 - Salt was separated from other ingredients by defining a separate food group for salt added in food preparation.

Food classification

Unprocessed

- Fruits, fresh/frozen
- Vegetables, fresh/frozen
- Meat/poultry/fish (MPF), not processed, dried, smoked, canned
- Unflavored milk, natural cheese
- Home recipes for bread, cake, baked goods
- Some grains (e.g., white rice, some cooked cereal)

Processed

- Canned, dried fruit; frozen juice
- Canned, pickled veg., prep. potatoes
- Processed meat (e.g., sausage, luncheon meat, dried, smoked canned, frozen MPF)
- Milk drinks, proc. cheese, flavored yogurt, ice cream
- Store bought baked goods, cake mix, crackers, chips, pasta, instant/quick oatmeal, ready-to-eat cereal
- Canned soup, frozen meals/entrees
- Salted butter, margarine, salad dressing, condiments, candy, bevg.

Modeling

- Mixed dishes from ingredients of recipes possibly commercially prepared and store-bought (e.g., potato/pasta salad, lasagna, pizza, burritos, pot pies, egg rolls, chow mein, chili, BBQ beef)

Data output

- Mean sodium and potassium intakes, and percentages of total sodium and potassium intakes contributed by each dietary source were determined
- NHANES sample-weighted data were used in all statistical analyses, and all analyses were performed using SUDAAN Release 9.0.3 (Research Triangle Institute, Research Triangle Park, NC) to adjust the variance for the clustered sample design.

Sodium intake (mg/day)

Mean daily sodium intake by ethnicity
within age and gender groups (Mean \pm SE)

Age and Gender	All Ethnic Groups (n=7,966)	Non-Hispanic White (n=3,324)	Non-Hispanic Black (n=2,130)	Hispanic (n=2,181)
All 2+ yr	3407 \pm 32	3464 \pm 43	3212 \pm 71	3269 \pm 76
Male	3918 \pm 45	4014 \pm 63 ^a	3607 \pm 102 ^b	3684 \pm 97 ^b
Female	2896 \pm 37	2911 \pm 47	2845 \pm 54	2832 \pm 110

NHANES, 2003-2004

Day 1 sample aged 2 years and older, excluding pregnant/lactating females

Sample-weighted mean and standard error are estimated using SUDAAN

^{a, b}, Race-ethnic groups not sharing an alphabetic character differ significantly ($p < 0.05$) using Bonferroni method

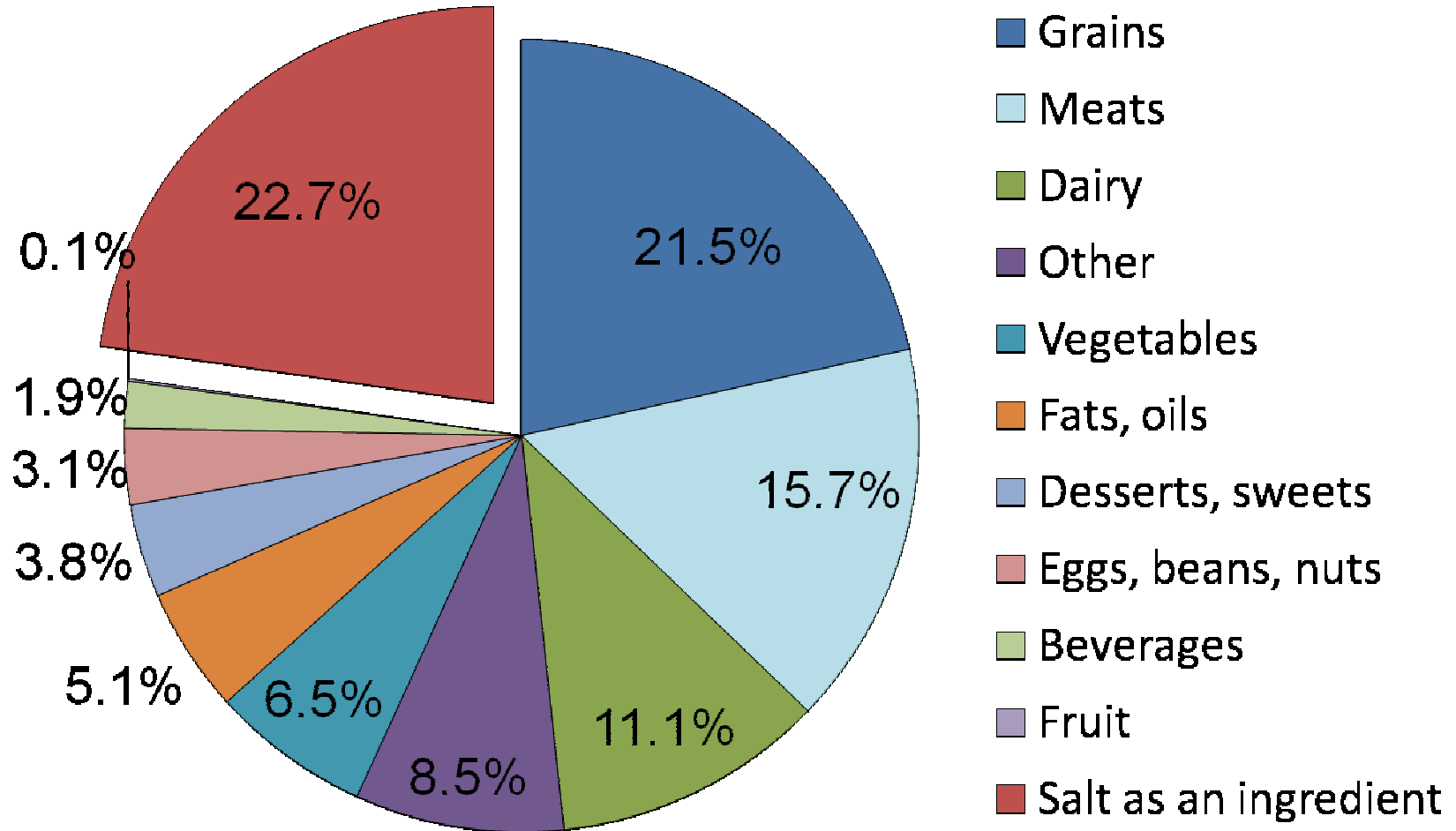
Sodium intake by food group (mg/day)

Food Group Classification of Ingredient	All 2+ yr (n=7,966)	
	Mean \pm SE	Pct (%)
Total (All Ingredients)	3407.1 \pm 31.7	100.0
Grain Products	730.8 \pm 10.4	21.45
Yeast breads and rolls	309.3 \pm 8.3	9.08
Biscuits, corn bread, pancakes, tortillas	120.8 \pm 6.7	3.55
Crackers, popcorn, pretzels, chips	148.3 \pm 5.2	4.35
Vegetables	222.7 \pm 5.8	6.54
Fruit (includes fruit juice)	4.1 \pm 0.2	0.12
Dairy Products	379.1 \pm 7.9	11.13
Cheese	266.6 \pm 7.0	7.83

Sodium intake by food group, cont.

Food Group Classification of Ingredient	All 2+ yr (n=7,966)	
	Mean \pm SE	Pct (%)
Meat, Poultry, Fish	534.0 \pm 15.2	15.67
Pork, ham, bacon	142.7 \pm 11.3	4.19
Frankfurters, sausages, luncheon meat	245.4 \pm 7.8	7.20
Eggs, Legumes, Nuts & Seeds	106.8 \pm 5.2	3.13
Fats and Oils	175.2 \pm 4.0	5.14
Desserts and Sweets	127.7 \pm 3.8	3.75
Beverages	63.8 \pm 2.5	1.87
Other Foods	289.1 \pm 12.2	8.48
Soup, broth, bouillon	109.1 \pm 4.9	3.20
Condiments and sauces	172.1 \pm 9.2	5.05
Salt Used as an Ingredient	773.9 \pm 10.6	22.72

Sodium intake by food group



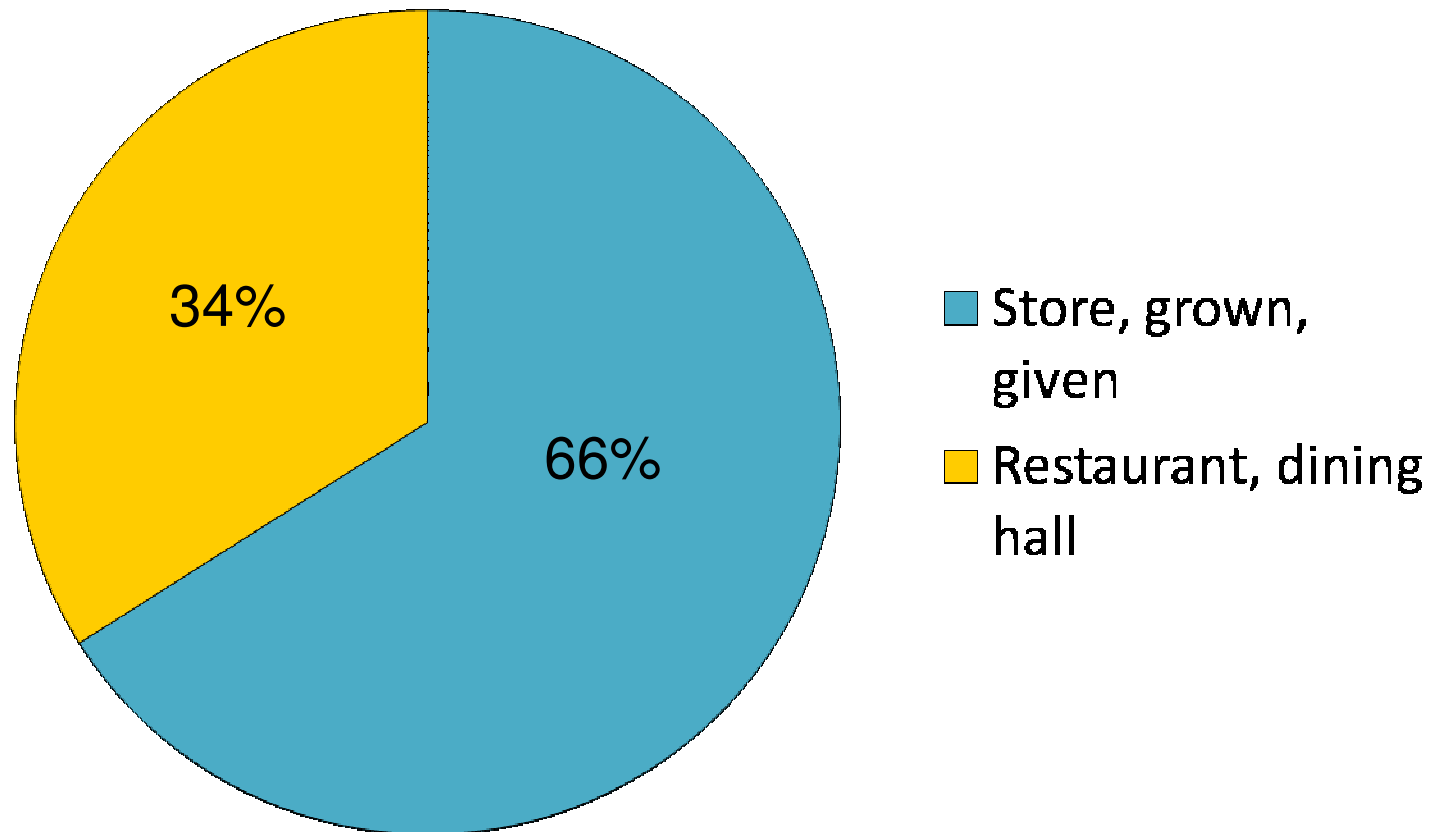
Sodium intake by food source (mg/day)

Classification of Processed and Unprocessed Foods	Mean \pm SE	Pct (%)
Total Sodium Intake	3407.1 \pm 31.7	100.0
<u>From Store, Grown, or Given</u>		
Processed Foods	1494.9 \pm 27.1	43.9
Processed Ingredients	1335.6 \pm 25.8	39.2
Unprocessed Ingredients	30.5 \pm 1.4	0.9
Salt Used as an Ingredient	128.9 \pm 5.8	3.8
Unprocessed Foods	753.6 \pm 17.8	22.1
Processed Ingredients	205.6 \pm 7.0	6.0
Unprocessed Ingredients	222.7 \pm 6.8	6.5
Salt Used as an Ingredient	325.3 \pm 8.7	9.5

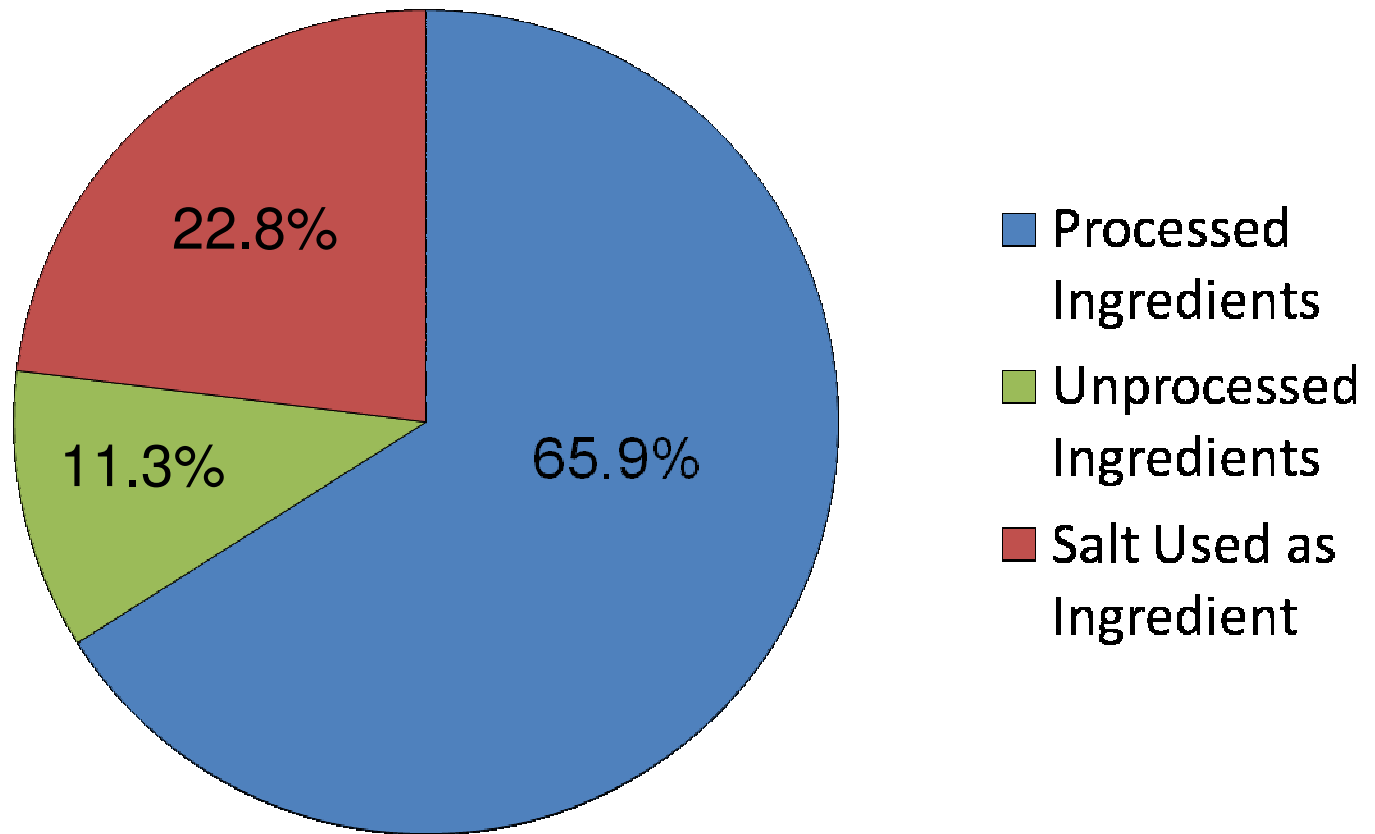
Sodium intake by food source, cont.

Classification of Processed and Unprocessed Foods	Mean \pm SE	Pct (%)
<u>From Restaurant or Dining Hall</u>		
Processed Foods	571.4 \pm 20.1	16.8
Processed Ingredients	446.8 \pm 17.0	13.1
Unprocessed Ingredients	30.6 \pm 2.8	0.9
Salt Used as an Ingredient	94.0 \pm 6.6	2.8
Unprocessed Foods	587.2 \pm 13.5	17.2
Processed Ingredients	258.6 \pm 8.4	7.6
Unprocessed Ingredients	102.8 \pm 3.4	3.0
Salt Used as an Ingredient	225.8 \pm 6.1	6.6

Share of sodium intake by food source



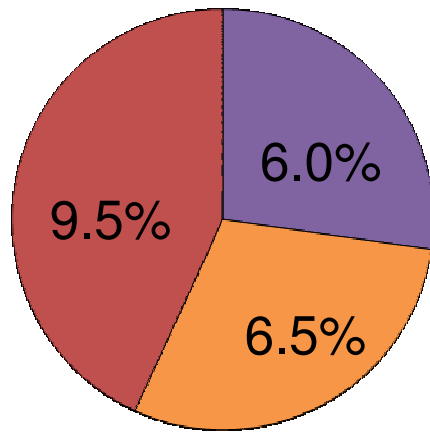
Share of sodium intake by ingredient type from all food sources



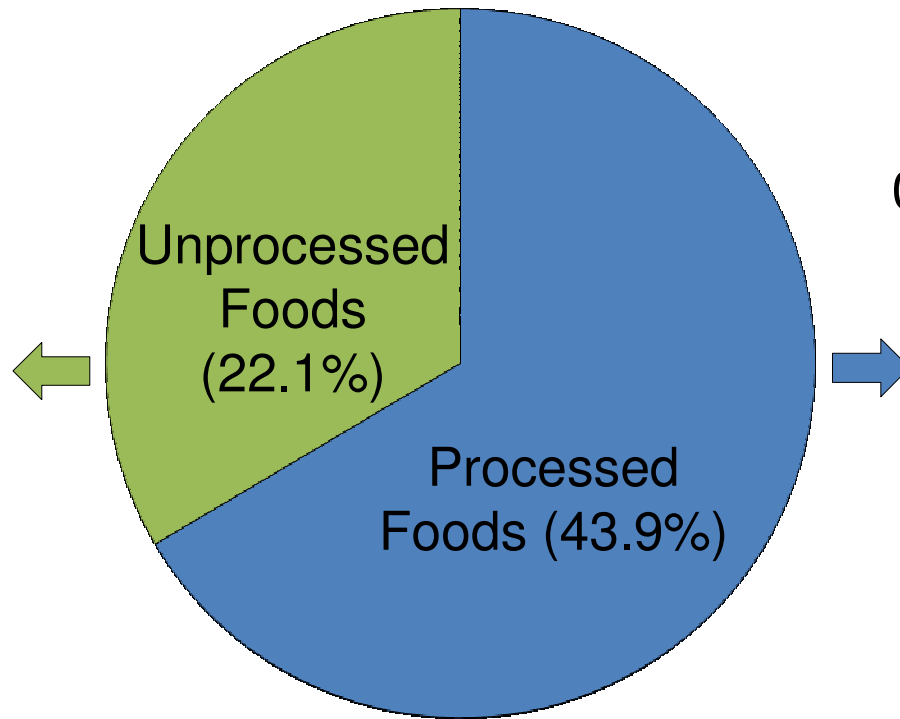
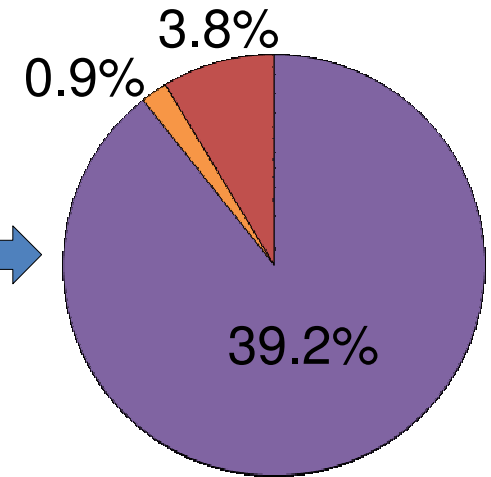
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Share of total sodium intake from store, grown, or given food sources

Unprocessed Foods



Processed Foods

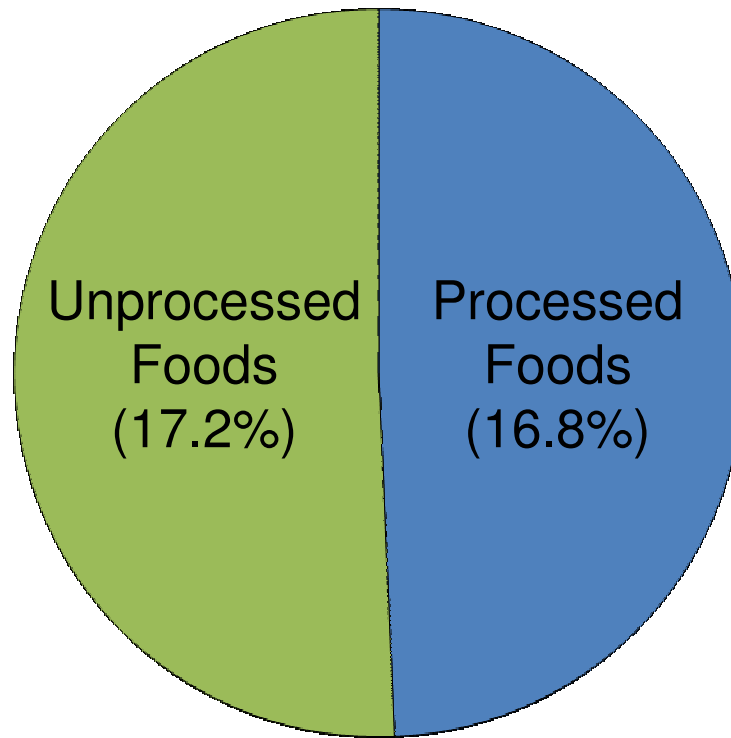
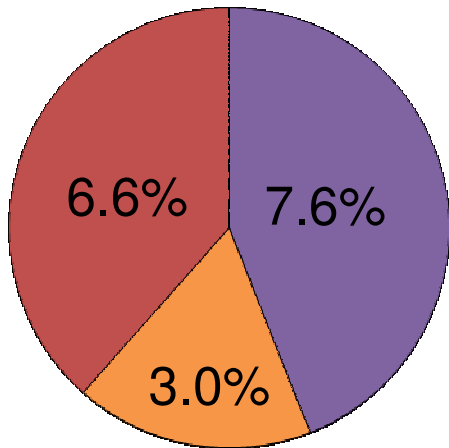


- Processed Ingredients
- Unprocessed Ingredients
- Salt Used as Ingredient

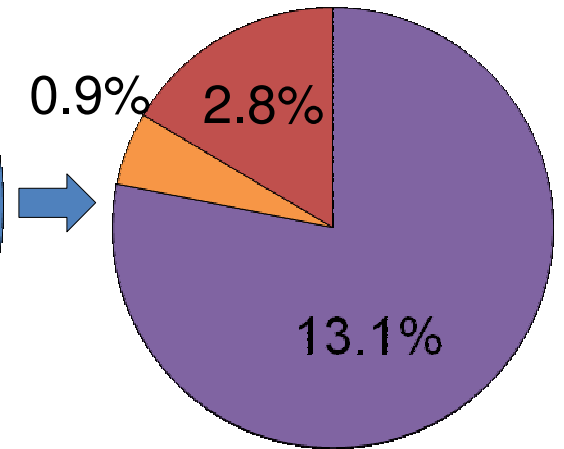
NHANES, 2003-2004

Share of total sodium intake from restaurant or dining hall

Unprocessed Foods



Processed Foods



- Processed Ingredients
- Unprocessed Ingredients
- Salt Used as Ingredient

Summary

- Salt use across food groups is quite ubiquitous
- Foods obtained from restaurant or dining halls provide about one-third (34%) sodium intake
- Foods obtained from stores, grown, or given provide about two-thirds (66%) sodium intake

Summary (cont.)

- Processed ingredients of foods obtained from all sources provide about two-thirds sodium
- Processed ingredients of foods plus salt used as an ingredient from restaurant/dining hall provides about 75% of sodium intake
- Salt used as an ingredient of foods, at the discretion of the individual, provides about 9.5% of sodium intake

Comments

- Limitations
 - Results depend on accuracy of 24-hr recalls
 - Qualitative criteria (not objective quantitative criteria) used to define processed foods
 - Results depend on accurate recipes in FNDDS
 - Cannot separate out salt added to ingredients
- Strengths
 - Large representative sample of US population
 - Validation of improved 24-hr recall method
 - Modeling to assign equivocal foods as processed
 - Sodium intake adjusted for variable salt ingredient

