

Variability of Sodium in Foods From Independent Ethnic Restaurants and Family-Style Chain Restaurants

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Abstract

Excessive dietary sodium is a major risk factor for hypertension, which is a key contributor to cardiovascular disease and stroke. The majority of sodium consumed in the U.S. is derived from processed and restaurant-prepared foods. The USDA-ARS Nutrient Data Laboratory recently analyzed sodium levels in several menu items from family-style chain restaurants and independent Chinese and Latino restaurants. For each food, up to 12 locations were identified using the USDA National Food and Nutrient Analysis Program's multi-stage, probability-proportional-to-size national sampling plan. Sample units were homogenized by menu item and sent with quality control materials to pre-qualified laboratories where sodium was determined using the ICP method. Mean sodium levels ranged from 243 to 435 mg/100 g among eight different Chinese dishes, and coefficients of variation (CV) ranged from 13% (general tso's chicken) to 60% (lemon chicken). Mean sodium levels among seven different Latino dishes were 277 to 518 mg/100 g, while the CV ranged from 15% (pork tamale) to 75% (bean pupusa). Across the four chain restaurants studied, macaroni and cheese (mean sodium 317-417 mg/100 g) had the least variability (average CV = 6%) and french fries (means 46-521 mg/100 g) had the highest (average CV = 39%). On average, variability of sodium within family-style chain restaurants was less than variability among independent ethnic restaurants, with some foods or restaurant chains more consistent than others. These data, which are included in the USDA National Nutrient Database for Standard Reference, Release 24, allow for more accurate monitoring of sodium intake of the U.S. population.

Introduction

Asian Americans are being oversampled in NHANES 2011-14, and according to the 2010 Census, they represent the fastest growing minority group in the U.S. Hispanic groups have been expanding at a fast pace, as well. To improve the coverage of foods consumed by these populations, the Nutrient Data Lab has increased the number of Asian and Latino foods analyzed as part of its National Food and Nutrient Analysis Program (NFNAP). High-consumption family-style restaurant foods that may substantially contribute to sodium intake in the U.S. diet were also sampled and analyzed under NFNAP. The variability of sodium in those dishes were studied and compared.

Methods and Materials

Chinese Restaurant Sampling Protocol

- ❖ National Food and Nutrient Analysis Program's (NFNAP) multi-stage, probability-proportional-to-size sampling design used to determine which restaurants to sample.
- ❖ NHANES 2005-06 data were used to identify foods for analysis.
- ❖ Contractor picked up each entrée from 12 statistically selected locations across the U.S.

Latino Restaurant Sampling Protocol

- ❖ Initially, four Hispanic Community Health Study locations, plus study diet center site (Minneapolis), based on size of Hispanic communities: Bronx-NY (Puerto Rican, Dominican); Miami-FL (Cuban, Central/South American); San Diego-CA (Mexican); Chicago-IL (Mexican, Puerto Rican, Central/South American) were used for sample pickup.
- ❖ Later, a sampling plan based on geographic distribution of Hispanic population, similar to the NFNAP plan. Sample proportioned to four census regions according to their size, among 12 counties nationwide within census regions according to their Hispanic population.

Family-style Restaurants Sampling Protocol

- ❖ Four family-style chain restaurants were targeted for sampling based on trade magazine sales and marketing data.
- ❖ Popular children's menu items -- macaroni and cheese and chicken fingers -- were chosen due to concerns about childhood obesity. Other menu items were chosen based on trade magazine data.
- ❖ NFNAP sampling design was used to determine which 12 cities/locations to sample.

Sample Preparation and Analysis:

- ❖ Menu items were shipped on dry ice by overnight delivery to the Food Analysis Laboratory Control Center (FALCC) at Virginia Tech, a NFNAP collaborator, for sample preparation. Foods were weighed and measured.
- ❖ Composites were prepared according to NDL instructions and homogenized.
- ❖ Composites were shipped to pre-qualified analytical labs along with the appropriate quality control and reference materials.
- ❖ Composites were analyzed for sodium using the inductively coupled plasma (ICP) method.

Results

- ❖ The entrée with the highest sodium level -- general tso's chicken -- had the least variability among Chinese restaurants (CV = 13%), whereas the entrée with the lowest sodium level -- lemon chicken -- had the highest variability (CV = 60%), Figure 1 and Table 1.
- ❖ Mean sodium levels among seven different Latino dishes ranged from 277 (corn tamale) to 518 (chicken and rice) mg/100 g. Coefficients of variation ranged from 15% (pork tamale) to 75% (bean pupusas), Figure 2 and Table 2.
- ❖ Across the four chain restaurants, macaroni and cheese had the least variability (average CV 6%) and french fries had the highest variability (average CV 39%), Table 3.
- ❖ Chain D fries had the lowest average sodium (46 mg/100 g) but highest variability (65%); Chain D chicken fingers had a CV of 1% which may be due to their use of frozen product.

Figure 1. Variability of Sodium in Chinese Food

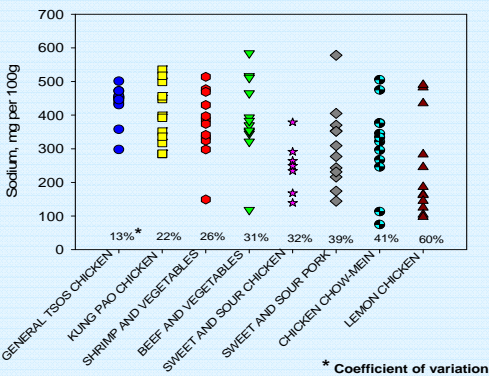


Table 1. Sodium Variability in Chinese Restaurant Foods

Chinese Restaurant Items	Sodium, mg/100 g		
	Mean (SE)	Range	n
General tso's chicken	435 (16)	298-501	12
Kung pao chicken	402 (26)	284-535	12
Shrimp and vegetables	375 (28)	149-514	12
Beef and vegetables	393 (21)	117-584	12
Sweet and sour chicken	246 (30)	139-379	7
Sweet and sour pork	304 (34)	144-578	12
Chicken chow mein	311 (37)	75-505	12
Lemon chicken	243 (42)	97-490	12



Figure 2. Variability of Sodium in Latino Foods

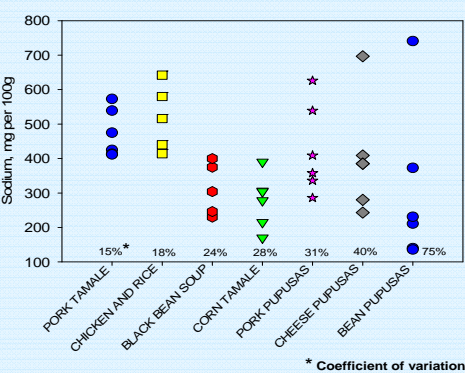


Table 2. Sodium Variability in Latino Restaurant Foods

Latino Restaurant Items	Sodium, mg/100 g		
	Mean (SE)	Range	n
Pork tamale	473 (28)	412-539	6
Chicken and rice	518 (42)	414-642	5
Black bean soup	311 (34)	230-400	5
Corn tamale	277 (31)	170-390	6
Pork pupusas (con cerdo)	426 (53)	286-626	6
Cheese pupusas (con queso)	400 (65)	243-697	6
Bean pupusas (con frijoles)	305 (94)	136-741	6



Table 3. Sodium Variability in Family-Style Chain Restaurant Foods

	Sodium, mg/100 g		
	Mean	Range	CV, %
Macaroni and Cheese			
Chain A	380	358-409	5
Chain B	417	410-431	2
Chain C	359	339-382	6
Chain D	317	286-386	11
Average	368		6
Fried Shrimp			
Chain A	714	674-752	4
Chain B	685	574-888	17
Chain C	1136	998-1240	8
Chain D	877	802-962	7
Average	853		9
Chicken Fingers			
Chain A	555	454-654	12
Chain B	524	403-705	27
Chain C	684	520-985	30
Chain D	656	639-664	1
Average	605		18
Sirloin Steak			
Chain A	549	523-587	5
Chain B	194	63-278	40
Chain C	134	85-226	43
Chain D	349	313-382	9
Average	307		24
French Fries			
Chain A	521	265-590	17
Chain B	374	156-659	52
Chain C	48	37-64	22
Chain D	46	25-103	65
Average	247		39



Conclusions

- ❖ The sodium level in foods from family-style chain restaurants was less variable (average CV 19% for 5 menu items) than foods from independent Chinese and Latino restaurants (average CV 33% for both the 8 Chinese and 7 Latino dishes).
- ❖ The chain restaurants are more likely to have standardized recipes and thus more consistent results among their various outlets. Less standardization occurs for similar dishes among independent restaurants.
- ❖ Current public health initiatives to reduce sodium may result in lower sodium levels in restaurant foods and potentially lower sodium variability.
- ❖ These data, which are included in the USDA National Nutrient Database for Standard Reference, Release 24, allow for more accurate monitoring of sodium intake of the U.S. population.

References

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