Nationwide Variation of Sodium Levels and Portion Size of Chinese Restaurant Menu Items

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Funding Disclosure: Research was partially supported by CDC-USDA Agreement 60-1235-0-185 and NIH-USDA Agreement No. Y1CN5010.

ABSTRACT

Objective: Sodium levels are typically high in Chinese dishes due to use of ingredients such as soy sauce and monosodium glutamate. Chinese food is popular among many Americans, with the number of Chinese restaurants exceeding the total number of top three major fast food establishments. Since 2008, the Nutrient Data Lab has increased the number of Chinese foods analyzed through its National Food and Nutrient Analysis Program (NFNAP) to expand their inclusion in the USDA National Nutrient Database for Standard Reference. Variability of sodium in Chinese foods was examined. Materials and Methods: Twelve popular dishes were selected based on What We Eat in America, NHANES consumption data. Each dish was sampled from independently-owned restaurants in up to 12 nationwide locations using NFNAP's multi-stage, probability-proportional-to-size 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 Inductively Coupled Plasma (ICP) method. Frequency of means, coefficients of variation (CV), and analysis of variance (ANOVA) tests were conducted. Results: Mean sodium levels ranged from 252 to 553 mg/100 g among the 12 dishes, and differences in variability were indicated by CV's ranging from 13% (general tso's chicken) to 56% (lemon chicken). The weight of 1 order varied among the different restaurants for each dish, creating an even greater impact on the sodium level per order; e.g, an order of beef and vegetables from OK (average 461 g) had 544 mg sodium compared to 3791 mg in 1 order (average 649 g) from NY. Sodium levels per 100 g were consistent across four U.S. regions, but when based on an order size, significant differences were observed ($p<0.0001$). Significance: Researchers and dietitians should consider the high variability of sodium levels in prepared Chinese foods due to its impact on the amount of sodium consumed from these foods.

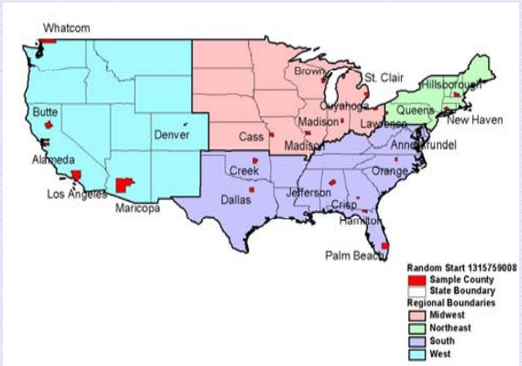
INTRODUCTION

Popular menu items were sampled nationally in 2009 and/or 2013 from independently-owned Chinese restaurants via USDA's National Food and Nutrition Analysis Program (NFNAP) to expand this category of foods in the USDA National Nutrient Database for Standard Reference (SR). Impact of individual restaurant, region of pick-up locations, and order size on variability of sodium levels was examined.

METHODS

- Eight different Chinese restaurant entrées were sampled for analysis in 2009. Lemon chicken and fried rice were re-sampled and four additional types of entrées were sampled in 2013.
- Menu item selection was based on What We Eat In America, NHANES 05-06 and 07-08 consumption data.
- National Food and Nutrition Analysis Program protocol [1]
  - Each menu item was sampled from retail outlets in 12 cities across the United States. Cities were selected using a multi-stage probability-proportional-to-size method (Figure 1).
  - Pick-up agents were told to shop at either a specified Chinese restaurant or one near the designated primary grocery store in each location.
  - Menu items were shipped on dry ice by overnight delivery to the Food Analysis Laboratory Control Center (FALCC) at Virginia Tech where each order was photographed and weighed.
  - FALCC prepared samples according to standard protocols and shipped composited samples to a pre-qualified analytical laboratory along with quality control materials.
  - The lab conducted analysis of sodium (minerals) using a modified AOAC Inductively Coupled Plasma (ICP) method.
- Frequency of means, coefficients of variation (CV), and analysis of variance (ANOVA) tests were conducted on the sodium and weight data.

Figure 1. NFNAP regions and county sample (2000 design)



RESULTS & DISCUSSION

Sodium per 100 g (Table 1):

- Mean sodium levels ranged from 252 mg (lemon chicken) to 553 mg (orange chicken) per 100 g among the 12 dishes.
- General tso's chicken had the lowest variability in sodium levels (CV 13%) and lemon chicken had the greatest (56%).

Sodium per order size:

- The variability of sodium from each restaurant is even greater based on order size, as illustrated in Figure 2. The CV for sodium level in general tso's chicken and lemon chicken is 31% and 69%, respectively, and vegetable lo mein now has the lowest CV (25%).

Regional variability:

- Sodium levels per 100 g were consistent across 4 regions of the U.S. ($p=0.4347$, one-way ANOVA).
- Sodium levels per 1 order were significantly different between Chinese restaurants in the Midwest and Northeast, Midwest and West ($p<0.05$) and between the Midwest and South ($p<0.0001$) (Figure 3).

Table 1. Sodium values (mg per 100 g) by food item

Food Item	n	Mean	Std Dev	Minimum	Maximum	CV, %
Beef and Vegetables	12	393	120	118	584	31
Chicken Chow Mein	12	311	127	75	505	41
Chicken and Vegetables	11	431	113	273	711	26
Fried Rice Without Meat	12	361	96	215	509	27
General Tso's Chicken	12	435	55	298	501	13
Kung Pao Chicken	12	402	89	284	535	22
Lemon Chicken	14	252	141	97	490	56
Orange Chicken	9	553	183	381	950	33
Shrimp and Vegetables	12	375	98	149	514	26
Sweet and Sour Pork	12	304	118	144	578	39
Vegetable Chow Mein	10	344	92	227	528	27
Vegetables Lo Mein	12	430	63	371	578	15

Figure 2. Variability of sodium per 1 order of Chinese restaurant entrees

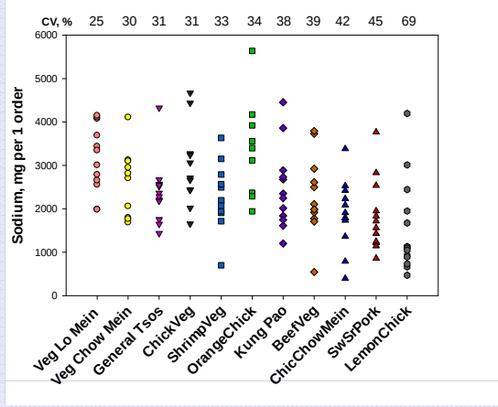
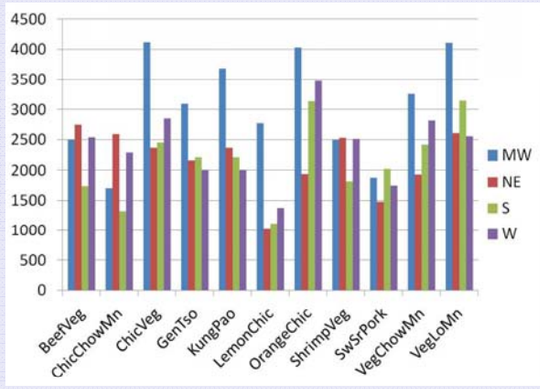


Figure 3. Sodium (mg) per 1 order by region of U.S.



CONCLUSIONS

- Sodium levels in Chinese restaurant foods are highly variable, which may impact the amount of sodium consumed from these foods.
- The weight of 1 order has an even greater impact on the variability of sodium due to the variability in order size among restaurants for each menu item.
- The wide variability in sodium levels of similarly named Chinese dishes makes monitoring changes in sodium levels especially challenging.
- SR release 26 [2] has 19 Chinese restaurant items, 14 of which are used in the What We Eat in America/NHANES 09-10 survey.

REFERENCES

[1] Haytowitz DB, Pehrsson PR, Holden JM. The National Food and Nutrient Analysis Program: A Decade of Progress. Journal of Food Composition and Analysis 2008; 21(Supp. 1):S94-S102.

[2] U.S. Department of Agriculture (USDA), Agricultural Research Service. 2013. USDA National Nutrient Database for Standard Reference, Release 26. Nutrient Data Laboratory Home Page, http://www.ars.usda.gov/nutrientdata.