HHS Public Access

Author manuscript

Procedia Food Sci. Author manuscript; available in PMC 2016 January 01.

Published in final edited form as:

Procedia Food Sci. 2015 ; 4: 114–124. doi:10.1016/j.profoo.2015.06.016.

Sodium Content of Foods Contributing to Sodium Intake: Comparison between Selected Foods from the CDC Packaged Food Database and the USDA National Nutrient Database for Standard Reference

Joyce Maalouf[a,b,*], **Mary E. Cogswell**[a], **Keming Yuan**[a], **Carrie Martin**[c], **Cathleen Gillespie**[a], **Jaspreet KC Ahuja**[c], **Pamela Pehrsson**[c], and **Robert Merritt**[a]

[a]Division for Heart Disease and Stroke Prevention, Centers for Disease Control and Prevention, Atlanta, GA 30341, USA

[b]IHRC, Inc., Atlanta, GA 30346, USA

[c]Agriculture Research Service, Beltsville Human Nutrition Research Center, US Department of Agriculture, Beltsville, MD 20705, USA

Abstract

The sodium concentration (mg/100g) for 23 of 125 Sentinel Foods (e.g. white bread) were identified in the 2009 CDC Packaged Food Database (PFD) and compared with data in the USDA's 2013 National Nutrient Database for Standard Reference(SR 26). Sentinel Foods are foods identified by USDA to be monitored as primary indicators to assess the changes in the sodium content of commercially processed foods from stores and restaurants. Overall, 937 products were evaluated in the CDC PFD, and between 3 (one brand of ready-to-eat cereal) and 126 products (white bread) were evaluated per selected food. The mean sodium concentrations of 17 of the 23 (74%) selected foods in the CDC PFD were 90%–110% of the mean sodium concentrations in SR 26 and differences in sodium concentration were statistically significant for 6 Sentinel Foods. The sodium concentration of most of the Sentinel Foods, as selected in the PFD, appeared to represent the sodium concentrations of the corresponding food category. The results of our study help improve the understanding of how nutrition information compares between national analytic values and the label and whether the selected Sentinel Foods represent their corresponding food category as indicators for assessment of change of the sodium content in the food supply.

Keywords

sodium; Sentinel Foods; database; laboratory analysis

[*]Corresponding author. Tel.: +1-770-488-8093; fax: +1-770-488-8334. address:vjh6@cdc.gov.

Disclaimer

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention or the United States Department of Agriculture

1. Introduction

Pervasive excess sodium intake in the US population[1] and the established link between high sodium consumption and high blood pressure, a leading cause of heart disease and stroke[2], have led to increased efforts to reduce the sodium in the US food supply. The majority of sodium intake (77%) is estimated to come from commercially processed and restaurant foods[3], thus accurate assessment and monitoring of the sodium and related nutrient content in these foods are important components of sodium reduction efforts.[4,5]

A key recommendation in the 2010 Institute of Medicine (IOM) report "Strategies to Reduce Sodium Intake in the United States" was to enhance monitoring and surveillance of sodium content of foods utilizing current and new methodologies and data sources.[4] In response to this recommendation, the US Department of Agriculture (USDA), the Centers for Disease Control and Prevention (CDC), and the Food and Drug Administration (FDA) launched collaborative efforts to improve the assessment and monitoring of sodium in the US food supply. Because it would be impossible to perform laboratory analysis of the nutrient composition for every food currently available in the United States, select foods known to be major contributors of sodium in the food supply and to the average diet were identified for the Sentinel Food monitoring program.[6,7]A total of 125 "Sentinel Foods" which consist primarily of commercially processed and restaurant foods, were selected for more frequent analysis and monitoring. These Sentinel Foods will serve as indicators for assessment of changes in the sodium content within broader categories in the US food supply.[6,7] The USDA's National Nutrient Database for Standard Reference (SR), is a publically available database of nutritional composition for over 8,600 foods and the Sentinel Foods are part of SR.[8]

In addition to laboratory analysis, it is also possible to monitor the sodium content in commercially processed and packaged foods using the Nutrition Facts Panel (NFP) label, available through public and proprietary databases.[9] To examine the nutrient composition of brand-name products, researchers at the CDC created a packaged food database combining proprietary and publicly available sales and NFP data[10], similar in concept to databases created by the New York City's National Sodium Reduction Initiative[11], and in other countries.[12–15] CDC is using this database to monitor the sodium content in major brands of commercially packaged food products.[10] However, according to FDA regulation, the sodium value on the NFP can exceed the actual sodium content of a food by up to 20%[16]; therefore, the NFP may not reflect stealth reductions, if they are less than 20% of the labeled sodium content. This may limit the usefulness of databases based on NFP to detect changes in the sodium content of the U.S. food supply.

Laboratory analyses, such as those provided for the sodium values of the Sentinel Foods available in the USDA SR[8] are the most accurate source of sodium information and can capture a variety of nutrients for commercially processed food items including nutrients (e.g., potassium, iodine) not currently required on the NFP. However, the selected Sentinel Foods and brands representing a specific food category is a major factor in the usefulness of the sentinel food monitoring program.

To address these gaps, the objectives of this study were two-fold. First, we evaluated and compared the sodium concentration of selected Sentinel Foods contributing to sodium intake as identified in the 2009 CDC Packaged Food Database (PFD) with the sodium concentration for these foods identified in the USDA's 2013 SR (SR 26). Second, we determined whether the selected Sentinel Foods represented adequately their corresponding food category, i.e. as indicators for assessment of change of the sodium content in the food supply.

2. Methods

2.1. CDC Packaged Food Database

To create the CDC Packaged Food Database (PFD), sales data from Nielsen ScanTrack data (The Nielsen Co, New York, NY)[17] were combined with NFP data from Gladson LLC (Lisle, IL)[18] and manufacturer websites. Universal Product Code (UPC) sales data for the 2009 calendar year were obtained from the Nielsen ScanTrack database, which captures all products sold in the US grocery stores with annual sales ≥$2 million.[17] However, sales data from Nielsen ScanTrack do not include warehouse stores, retailers with sales less than $2 million, or non-UPC coded products.[17] UPC-level sodium data mainly were obtained from the 2009 Gladson nutrition database, which includes all nutrition information as it appears on the NFP, as well as packaging information such as size, product description, and brand. Both Nielsen and Gladson data include private label/store brand products, but these tend to vary by region and market, and due to the poor matching of UPCs, private label products were excluded.[10] The final database included complete sales and nutrition information on 7,898 commercially processed food items that comprise the top 80% in sales volume from major US grocery stores in 63 of 104 food categories. Additional details on the CDC Packaged Food Database, food categories, Gladson and Nielsen databases can be found elsewhere.[10, 17–19]

2.2. USDA National Nutrient Database for Standard Reference (SR)

The USDA SR is the major source of food composition data in the United States.[8] SR is the basis for many other databases in the US, including the USDA's Food and Nutrient Database for Dietary Studies (FNDDS), which is used to analyze dietary intake data from What We Eat in America, the dietary component of the National Health And Nutrition Examination Survey (WWEIA, NHANES).[20] The SR and FNDDS contain brand-level information for certain food categories, such as ready-to-eat cereals and infant formulas. SR is released annually and for the purpose of this study, we used the version 26 (SR 26), released in 2013.[21]

2.3. Sentinel Foods

Sentinel Foods were selected using dietary intake data from WWEIA, NHANES 2007–2008, and accounted for approximately one-third of the total sodium intake of all individuals, excluding breastfed infants.[22] The FNDDS 4.1[23] was used to calculate the dietary sodium intakes for WWEIA, NHANES 2007–2008 and incorporated sodium values from SR 22.[24] To select the Sentinel Foods, criteria such as sodium density (mg/100 g of food or beverage), frequency of consumption by survey respondents, and percent

contribution to sodium intake were evaluated. A total of 125 FNDDS and corresponding SR foods and beverages were selected as Sentinel Foods to be monitored as primary indicators of change for assessing the sodium content of foods and beverages in a given WWEIA Food Category. The WWEIA Food Categories group similar foods and beverages into one of about 150 mutually exclusive categories based on usage and nutrient content.[25] The nutrient content for corresponding Sentinel Foods in the SR are based primarily on laboratory analyses of brands of foods selected using a previously developed and reported nationwide food sampling and analysis plan (NFNAP).[6,7,26] Additional details related to the selection, sampling and analysis of Sentinel Foods selection can be found elsewhere.[27]

2.4. Sample selection

For the purpose of this study, we selected 23 Sentinel Foods, of which15 were from the top 10 food categories contributing the most to U.S. sodium intake (e.g., bread and cheese) in 2007–2008[19] (Table 1).The remaining 8 Sentinel Foods were chosen to represent foods contributing at least 3% of sodium intake among socio-demographic subgroups (e.g., frankfurters and sausages and ready-to-eat cereals consumed by 2–19 years old; tortilla and salsa consumed by Mexican-Americans)[19] (Table 1). In close collaboration with the USDA, a nutritionist matched each selected Sentinel Food to foods in the CDC PFD using the item description and product details in the PFD. If more details related to the ingredients were needed, the nutritionist searched the manufacturer and other websites using a standardized internet search protocol.[10] Table 1 provides details related to each selected Sentinel Food, including the number representing the food in SR and its description (NDB), the basis for the nutrient composition in SR and the corresponding WWEIA food category.

2.5. Statistical Analysis

We examined the sales-weighted mean and distribution (standard error (SE), range, and coefficient of variation (CV)) of the sodium concentration (mg/100 g) of the 23 Sentinel Foods as identified in the CDC PFD. We compared these values with the mean (SE) and range of sodium concentration of the foods (mg/100 grams) matched in SR 26. To evaluate whether the difference in mean sodium concentrations was significantly different between the two databases, we used sample t-tests, when possible ($P<0.05$). We also computed the percent ratio for each food equal to the mean sodium value in USDA SR 26 divided by the mean sodium value in CDC PFD, multiplied by 100. Although not all the values for Sentinel Foods in SR 26 are based on laboratory analysis, the ratio is based on analyzing compliance with FDA regulations for nutrition information on the NFP, i.e., the laboratory value divided by the label value multiple by 100.[16] To determine how representative the sodium content of the selected Sentinel Food (e.g., chili con carne) was for its corresponding food category (meat mixed dishes), we used data from the PFD and SR 26. We determined the median and interquartile range (IQR) for sodium (mg/100g) from the PFD for each Sentinel Food, its corresponding food category, and top selling brands. SAS version 9.3 (Cary, N.C.) was used for all analyses.

3. Results

Overall, 937 products were evaluated in the CDC PFD, and between 3 (one brand of ready-to-eat (RTE) cereal) and 126 products (white bread) were evaluated per selected food (Table 2). The range of sodium concentration varied by food from 449–472 for one brand of RTE cereal to 476–1587 for ranch dressing (Table 2). The mean sodium concentrations of 17 of the 23 (74%) selected foods in the CDC PFD were 90%–110% of the mean sodium concentrations in SR 26 (Table 2). The coefficient of variation (CV) for the sodium concentration of the selected foods using the CDC PFD ranged between 2% for one type (and brand) of RTE cereal (n=3 products) to 31% for RTE chicken noodle soup (n=15 products). The sodium concentration in USDA SR26 was >110% of the CDC PFD for ham (114%), and <90% for canned spaghetti with meatballs (84%), unflavored potato and tortilla chips (76%), and two brands of RTE cereals (65% and 77%) (Table 2). The difference in mean sodium concentration (mg/100 g) was statistically significant between the CDC PFD and USDA SR for the following Sentinel Foods: American cheese ($p=0.042$), Spaghetti with meatballs ($p=0.001$), chili with meat and beans ($p=0.021$), white tortilla chips ($p=0.001$), ranch dressing ($p=0.001$) and beef hotdogs ($p=0.036$) (Table 2).

Figures 1–3 show the median and IQR (25th and 75th percentile) of sodium concentration (mg/100 g) in top-selling brands of selected Sentinel Foods using the CDC PFD compared to their corresponding food category and to the mean sodium concentration in USDA's SR 26. The IQR of the PFD sodium concentration for white bread, cheese pizza, lasagna with meat, and unflavored potato chips overlapped with the IQR of sodium values of foods in their corresponding food categories: breads and rolls, pizza, pasta mixed dishes, and savory snacks, respectively (Figure 1). In addition, the medians of the Sentinel Foods in the PFD were within 90% to 110% of the median of their corresponding food category. However, the median sodium concentration of the top brands varied and for some was higher or lower than the median sodium concentration of the Sentinel Food in the PFD or the mean sodium concentration of the Sentinel Food in SR 26 (Figure 1).

For some foods, the median sodium concentration of the Sentinel Foods in the PFD were either >110% or <90% of the median sodium concentration for foods within their corresponding food category (Figure 2). The IQR of the sodium concentration in the PFD overlapped with the IQR of the corresponding food category except for unflavored tortilla chips (Figure 2). Similar to other Sentinel Foods, high variability in the sodium concentrations between brands was observed (Figure 2).Figure 3 compares the sodium concentration of the Sentinel Foods cheddar cheese and American cheese and their corresponding food category, cheese. The median sodium concentration in the PFD for American cheese is at the high end of IQR for the food category, cheese, whereas the median sodium concentration for cheddar cheese is below the lower end of the IQR for cheese (Figure 3). The median sodium concentration of the top selling brands of cheddar and American cheese didn't vary much and was similar to the mean sodium concentration of the corresponding Sentinel Food in SR26 (Figure 3).

4. Discussion

This study compared the sodium concentration of selected foods contributing to sodium intake as identified in the 2009 CDC PFD and the sodium concentration for these foods identified in the USDA's 2013 SR 26. Whereas, the mean sodium concentrations of most of the selected Sentinel Foods evaluated in these two databases were similar, some differed. The differences in sodium concentrations of some foods as determined in the PFD versus SR 26 might be due to one or more of the following factors: the sodium concentration was under- or over-reported on nutrition facts labels; the sodium concentration of the food changed over time (from 2009 to 2013) and/or the sodium concentrations of foods selected in SR 26 differed from the foods in the PFD, e.g., different brands (e.g., due to changes in market share), or private label vs major brands. For example, the Sentinel Food ham in the PFD only included branded name products whereas ham in the SR 26 also included private label/store brand products.

The wide range and high CV of some of the selected Sentinel Foods in the PFD (e.g. ready-to-eat chicken noodle soup or chicken nuggets) suggests the potential for sodium reduction due to the variability of sodium concentrations among these commercial food products as well as the need for monitoring changes in market share of specific brands over time. The sodium concentration of most of the Sentinel Foods, as selected in the PFD, appeared to represent the sodium concentrations of the corresponding food category. For some foods with a wide range of sodium concentration within the category, like cheese, selection of more than one sentinel food, e.g., American cheese and cheddar cheese, covered the range of sodium concentrations within the category. For others, one sentinel food may be sufficient to represent the category, e.g., the sodium concentration of unflavored potato chips was close to the sodium concentration of the category of savory snacks, whereas the sodium concentration of unflavored tortilla chips was below the interquartile range of sodium concentration for savory snacks. In these cases, other considerations may lead to the selection of more than one food, e.g., differences in consumption of specific foods within a category by socio-demographic subgroups.

Our findings cannot be directly compared to previous studies due to methodological differences in data collection, time frame and different databases used but our results add to the findings of previous studies. Two studies have also shown high variability in the sodium concentration within and between brands of cheese[28] and boxed macaroni and cheese.[7] The analytical sodium value was below the label value in both studies.[7,28] This may be due to the fact that some food manufacturers have voluntarily pledged to reduce sodium levels in their products.[29,30]

There are several limitations and challenges related to monitoring sodium in the food supply in general and to this study in specific. First, the identification of the selected Sentinel foods from the CDC PFD was resource and time intensive because the search had to be done manually. We limited the selected Sentinel Foods to major national brand commercially processed and packaged store foods because the 2009 CDC PFD does not include prepared food (e.g. potato salad from retail), restaurant foods (e.g. cheeseburger, fast foods), raw food (e.g. chicken) or private label/store brands.

Publicly available databases, like the USDA's SR and FNDDS, can facilitate the monitoring of the sodium content in the food supply. However, due to limited resources, the sodium content of foods in the databases are updated biennially, are not necessarily brand-specific, and thus may not reflect all changes in the marketplace, given that more than 85,000 "uniquely formulated foods" are currently available in the US.[5,9,27,31] Further, proprietary nutrition and sales databases are costly and also have their own limitations. First, these databases rely on the NFP and the enforcement laboratory analyses can exceed the sodium content on the label by up to 20% according to current FDA regulation.[16] Therefore, the NFP may not accurately reflect the nutrient composition of products, particularly if the manufacturer gradually reduces the sodium content without changing the label. Second, timeliness is an issue due to the passive data collection in some of the proprietary nutrition databases. In the 2009 Gladson database, "77% of the products were entered or updated between 2008 and 2010 and the remaining 23% were entered or updated prior to 2008".[10] The data acquisition for nutrition information of products with sales data in Nielsen that did not match nutrition information in Gladson was resource intensive and missing data had to be manually extracted from manufacturers' or other websites, which might not be regularly updated and could be inaccurate. On the other hand, laboratory analyses are also resource intensive, expensive, and not feasible for monitoring large numbers of foods. The cost of nationwide sampling and the nutrient analysis of one food is approximately $17–20,000 depending on the number of nutrients analyzed per food.[31] In this study, a total of 937 products were evaluated using the CDC PFD (range: 3–126 products/food) compared to 272 products using the USDA's SR 26 (range: 2–36 products/food). Therefore, nutrition databases based on the label provide a valuable less expensive method for monitoring brand-level commercially processed food items in the US food supply. The USDA uses sales data to prioritize the sampling of foods for laboratory analyses. Combining sources of nutrition information may be the best approach to monitor the sodium content of foods, with use of laboratory analyses to identify potential real time changes in the food supply or evaluate the accuracy of the sodium content of foods observed in brand-specific nutrient databases.[9]

The results of our study helped improve the understanding of how nutrition information compares between analytic values and the label. While the mean sodium concentrations of most of the selected Sentinel Foods evaluated in these two databases were similar, some differed. These and future results will also help determine how well the Sentinel Foods represent their corresponding food categories, and inform decisions about modifying the list of Sentinel Foods, to maintain its relevance to the dynamic US food supply. The variability in sodium concentration between top brands of specific foods indicates sodium reduction is feasible. Reducing the sodium content in commercially processed and packaged foods that are most commonly purchased by consumers can contribute to reducing the overall sodium intake in the US, which could avert thousands of deaths every year and save billions in health care dollars.[32]

References

1. Centers for Disease Control and Prevention. Usual sodium intakes compared with current dietary guidelines—United States, 2005–2008. MMWR Morb Mortal Wkly Rep. 2011; 60(41):1413–1417. [PubMed: 22012113]

2. Go AS, Mozaffarian D, Roger VL, Benjamin EJ, Berry JD, Blaha MJ, et al. Executive summary: heart disease and stroke statistics-2014 update: a report from the American Heart Association. Circulation. 2014; 129(3):399–410. [PubMed: 24446411]

3. Mattes RD, Donnelly D. Relative contributions of dietary sodium sources. J Am Coll Nutr. 1991; 10(4):383–393. [PubMed: 1910064]

4. Henney, JF.; Taylor, CL.; Boon, CS. Institute of Medicine. Strategies to Reduce Sodium Intake in the United States. Washington, DC: The National Academies Press; 2010.

5. Neal B, Sacks G, Swinburn B, Vandevijvere S, Dunford E, Snowdon W, et al. INFORMAS. Monitoring the levels of important nutrients in the food supply. Obes Rev. 2013; 14(Suppl 1):49–58. [PubMed: 24074210]

6. Ahuja JK, Moshfegh AJ, Holden JM, Harris E. USDA food and nutrient databases provide the infrastructure for food and nutrition research, policy, and practice. J Nutr. 2013; 143(2):241S–249S. [PubMed: 23269654]

7. Holden JM, Pehrsson PR, Nickle M, Haytowitz DB, Exler J, Showell B, Williams J, Thomas RG, Ahuja JKC, Patterson KY, Lemar LE, Gebhardt SE. USDA monitors levels of added sodium in commercial packaged and restaurant foods. Procedia Food Science. 2013; 2:60–67.

8. [Accessed March 23, 2015] USDA National Nutrient Database for Standard Reference. http://ndb.nal.usda.gov/.

9. Ng SW, Popkin BM. Monitoring foods and nutrients sold and consumed in the United States: dynamics and challenges. J Acad Nutr Diet. 2012; 112(1):41.e4–45.e4. [PubMed: 22389873]

10. Gillespie C, Maalouf J, Yuan K, Cogswell M, Gunn J, Levings J, Moshfegh A, Merritt R. Sodium content in major brands of US packaged foods, 2009. Am J Clin Nutr. 2015; 101(2):344–353. [PubMed: 25646332]

11. [Accessed March 24, 2015] New York City Department of Health and Mental Hygiene. National Salt Reduction Initiative. Available at: nyc.gov/health/salt.

12. Dunford EK EH, Mhurchu CN, Webster JL, Neal BC. Changes in the sodium content of bread in Australia and New Zealand between 2007 and 2010: implications for policy. MJA. 2011; 195(6): 346–349. [PubMed: 21929500]

13. Woodward E EH, Mhurchu CN. Key opportunities for sodium reduction in New Zealand processed foods. Aust NZ J Public Health. 2012; 36:84–89.

14. Mhurchu CN, Dunford EK, Webster JL, Neal BC, Jebb SA. Sodium content of processed foods in the United Kingdom: analysis of 44,000 foods purchased by 21,000 households. Am J Clin Nutr. 2011; 93:594–600. [PubMed: 21191142]

15. Webster JL, Neal BC. A systematic survey of the sodium contents of processed foods. Am J Clin Nutr. 2010; 91:413–420. [PubMed: 19955402]

16. US Department of Health and Human Services. , editor. [Accessed March 16, 2015] US Department of Health and Human Services, FDA, 21CFR101.9. http://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/LabelingNutrition/ucm063113.htm.

17. Nielsen Company. Available from: http://www.nielsen.com/us/en.html.

18. Gladson LLC. Available from: http://www.gladson.com/.

19. The Centers for Disease Control and Prevention. Food categories contributing the most to sodium consumption – United States, 2007–2008. Morbidity and Mortality Weekly Report. 2012; 61(5): 92–98. [PubMed: 22318472]

20. U.S. Department of Agriculture, Agricultural Research Service. USDA Food and Nutrient Database for Dietary Studies 2011–2012. Food Surveys Research Group; 2014. Home Page, http://www.ars.usda.gov/ba/bhnrc/fsrg. [Accessed March 16, 2015]

21. U.S. Department of Agriculture, Agricultural Research Service. 2013. USDA National Nutrient Database for Standard Reference, Release 26. Nutrient Data Laboratory; 2013 Aug. Home Page, http://www.ars.usda.gov/ba/bhnrc/ndl. [Accessed March 9, 2015]

22. [Accessed March 9, 2015] U.S. Department of Agriculture, Agricultural Research Service, Beltsville Human Nutrition Research Center, Food Surveys Research Group (Beltsville, MD) and U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics (Hyattsville, MD). What We Eat in America, NHANES

2007–2008 Data: Dietary Interview - Total Nutrients Intakes -- First Day (DR1TOT_C). 2010 Jul. Available from: http://wwwn.cdc.gov/nchs/nhanes/search/datapage.aspx?Component=Dietary&CycleBeginYear=2007.

23. U.S. Department of Agriculture, Agricultural Research Service. USDA Food and Nutrient Database for Dietary Studies, 4.1. 2010. Beltsville, MD: Agricultural Research Service, Food Surveys Research Group; Available at: http://www.ars.usda.gov/ba/bhnrc/fsrg. [Accessed March 9, 2015]
24. U.S. Department of Agriculture, Agricultural Research Service, USDA Nutrient Data Laboratory. [Accessed September 30, 2014] USDA National Nutrient Database for Standard Reference, Release 22. 2009. http://www.ars.usda.gov/Services/docs.htm?docid=20960.
25. U.S. Department of Agriculture, Agricultural Research Service. [Accessed March 1, 2015] What We Eat in America Food Categories. Internet: http://www.ars.usda.gov/ba/bhnrc/fsrg.
26. Trainer D, Pehrsson PR, Haytowitz DB, Holden JM, Phillips KM, Rasor AS, Conley NA. Development of sample handling procedures for foods under USDA's National Food and Nutrient Analysis Program. J Food Compost Anal. 2010; 23(8):843–851. [PubMed: 21516233]
27. Ahuja JK, Pehrsson PR, Haytowitz DB, Wasswa-Kintu S, Nickle M, Showell B, Thomas R, Roseland J, Williams J, Khan M, Nguyen Q, Hoy K, Martin C, Rhodes D, Moshfegh A, Gillespie C, Gunn J, Merritt R, Cogswell M. Sodium monitoring in commercially processed and restaurant foods. Am J Clin Nutr. 2015; 101(3):622–631. [PubMed: 25733648]
28. Agarwal S, McCoy D, Graves W, Gerard PD, Clark S. Sodium content in retail Cheddar, Mozzarella, and process cheeses varies considerably in the United States. J. Dairy Sci. 2001; 94:1605–1615. [PubMed: 21338828]
29. [Accessed March 16, 2015] New York City Department of Health and Mental Hygiene. National salt reduction initiative. http://www.nyc.gov/html/doh/html/diseases/salt-initiative-packagedfood.shtml.
30. PR Newswire. Kraft Foods on Track to Meet Sodium Reduction Goals Across North American Product Portfolio. 2012 http://www.prnewswire.com/news-releases/kraft-foods-on-track-to-meet-sodium-reduction-goals-across-north-american-product-portfolio-171344191.html.
31. Ahuja JKC, Moshfegh AJ, Holden JM, Harris E. USDA Food and Nutrient Databases Provide the Infrastructure for Food and Nutrition Research, Policy, and Practice. J Nutr. 2013; 143:241S–249S. [PubMed: 23269654]
32. Bibbins-Domingo K, Chertow GM, Coxson PG, et al. Projected effect of dietary salt reductions on future cardiovascular disease. N Engl J Med. 2010; 362(7):590–599. [PubMed: 20089957]

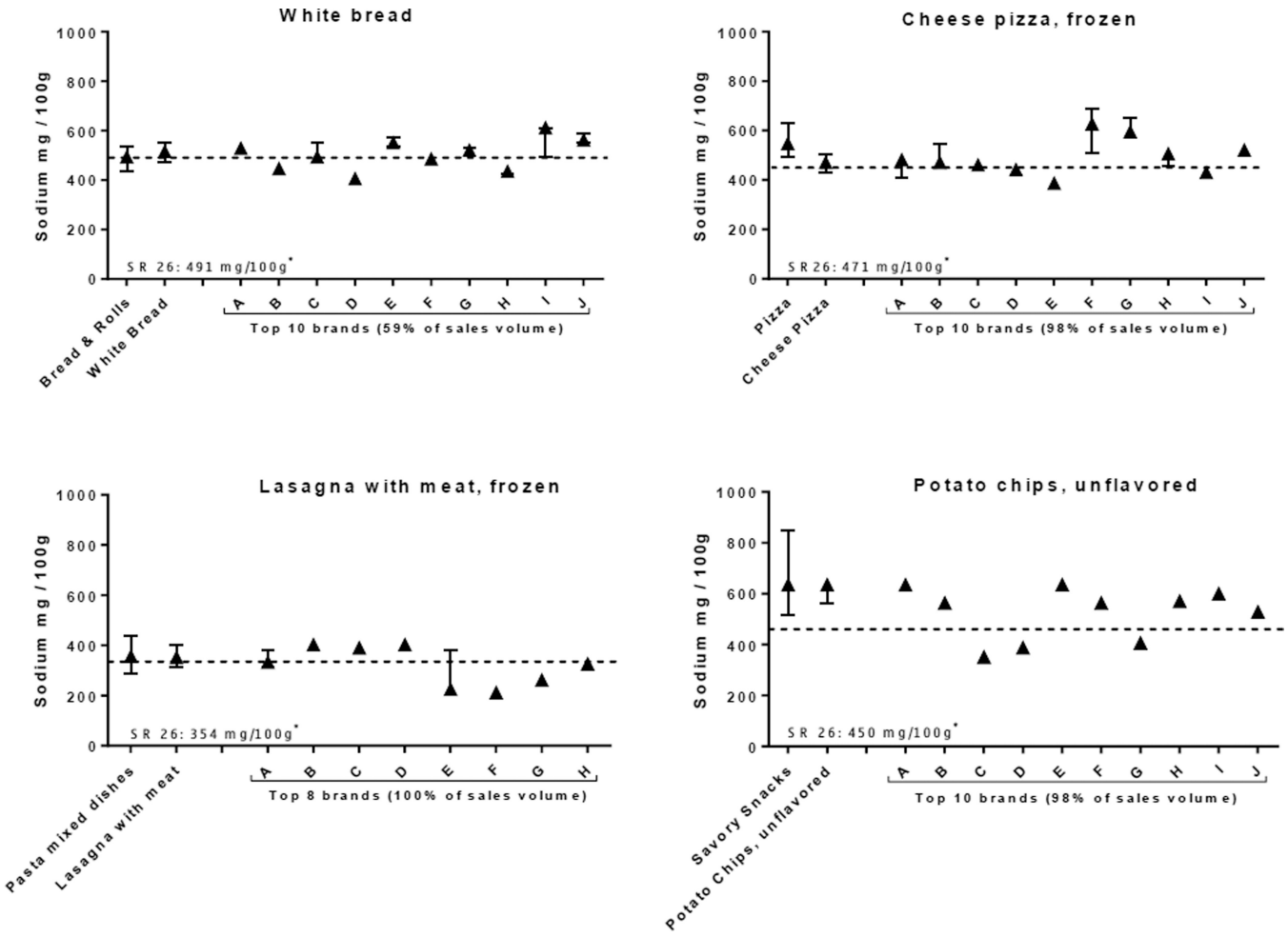

Fig.1.

Median (mg/100g) and interquartile range of sodium concentration in white bread, cheese pizza, lasagna with meat, and unflavored potato chips compared to their corresponding food category using CDC packaged food database

*Horizontal dashed line indicates the mean sodium (mg/100g) of the Sentinel Food in SR 26

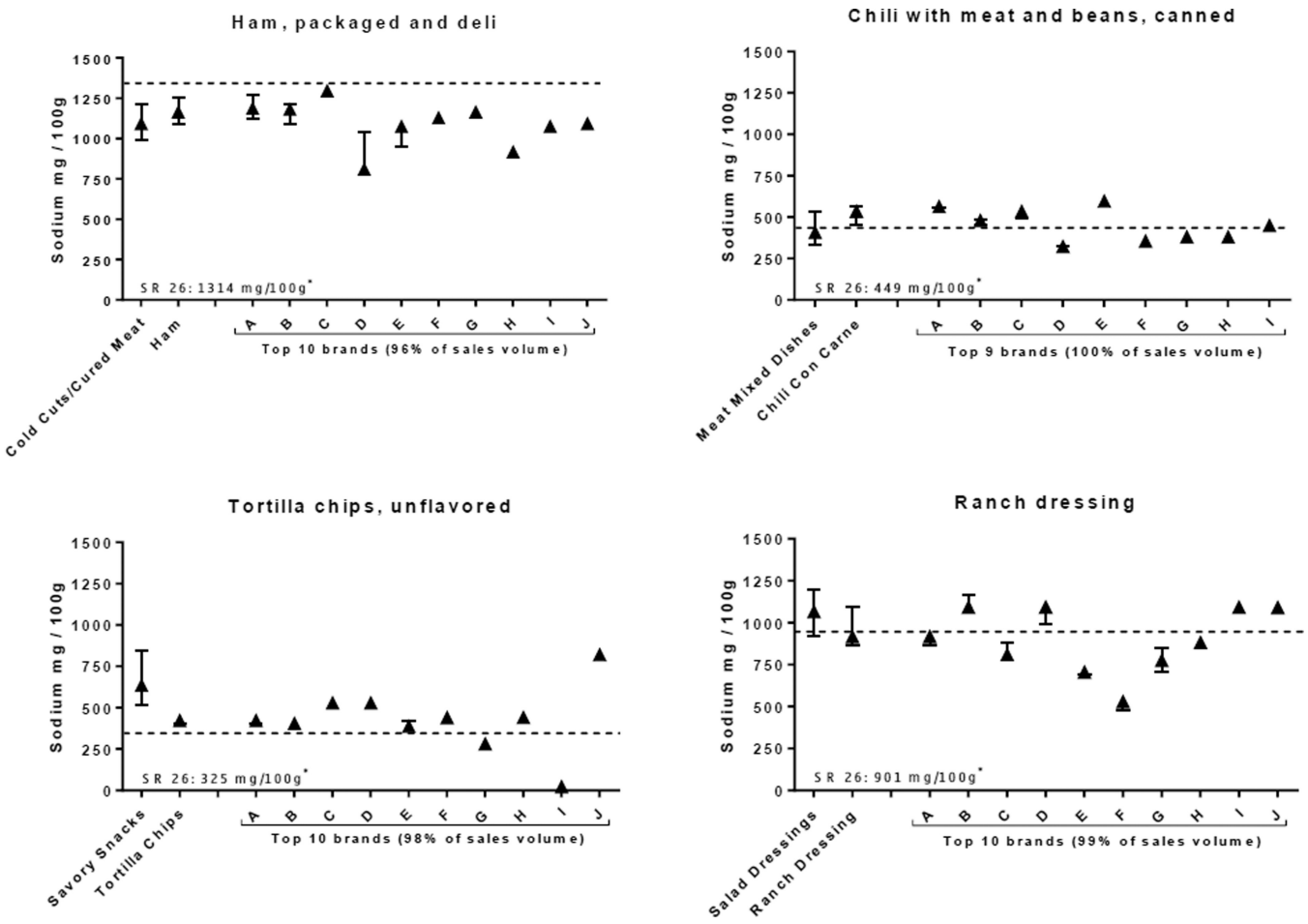

Fig.2.

Median (mg/100g) and interquartile range of sodium concentration in Ham, chili with meat and beans, tortilla chips, and ranch dressing compared to their corresponding food category using CDC packaged food database.

*Horizontal dashed line indicates the mean sodium (mg/100g) of the Sentinel Food in SR 26

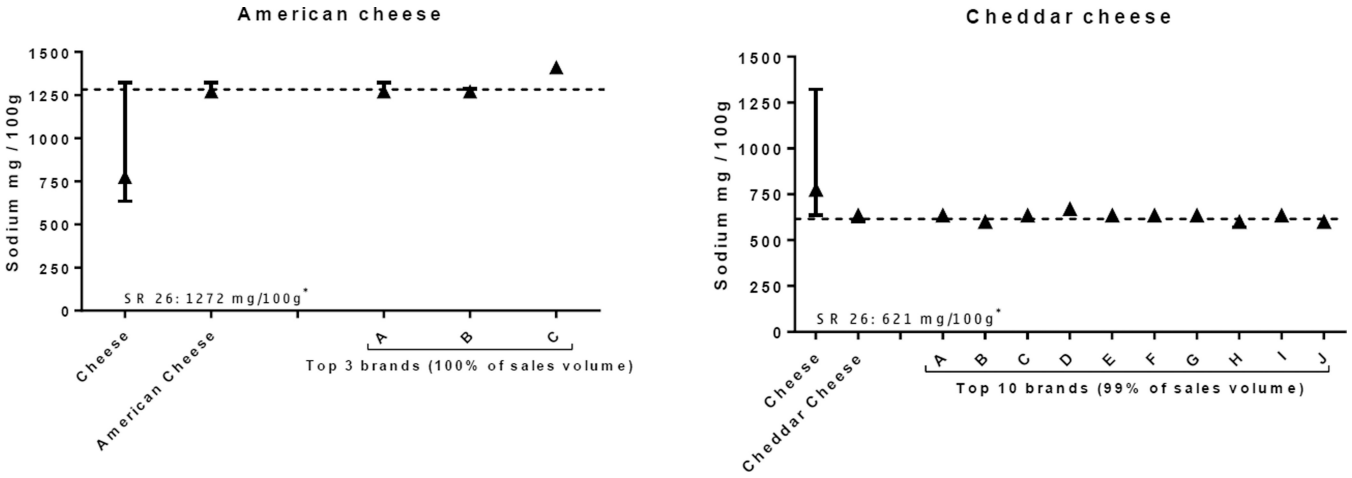

Fig.3.

Median (mg/100g) and interquartile range of sodium concentration in American and cheddar cheese compared to their corresponding food category using CDC packaged food database.

*Horizontal dashed line indicates the mean sodium (mg/100g) of the Sentinel Food in SR 26

Table 1

Sentinel Foods description, basis for the SR data and the corresponding WWEIA food category

Sentinel Food	NDB #	Description	Basis for SR 26 data	WWEIA Food Category
White bread	18069	Bread, white, commercially prepared (includes soft bread crumbs)	Analytical data, 2011; NFP review in 2012 – no change	Yeast breads and rolls
Hamburger roll	18350	Rolls, hamburger or hotdog, plain	Analytical data, 2011; NFP review in 2012 – no change	Yeast breads and rolls
Ham, packaged and deli	07028	Ham, sliced, prepackaged (96% fat free, water added)	Analytical data, 2013	Cold cuts and cured meats
Cheese pizza, thin crust, frozen	21505	Pizza, cheese topping, thin crust, frozen, cooked	Analytical data, 2012	Pizza
Chicken nuggets, frozen	22974	Chicken nuggets, frozen, cooked	Analytical data, 2013	Poultry
Chicken noodle soup, RTE	06018	Soup, chunky chicken noodle, canned, ready-to-serve	Analytical data, 2011	Soups
Chicken Noodle Soup, condensed	06019	Soup, chicken noodle, canned, condensed	Manufacturer's analytical; partial documentation, 2013	Soups
Corn dog, frozen	22973	Corn dogs, frozen, prepared	Analytical data, 2011	Sandwiches
American cheese	01252	Cheese product, pasteurized process, American, vitamin D fortified	Analytical data, 2011	Cheese
Cheddar cheese	01009	Cheese, cheddar	Analytical data, 1976; last analyzed in 2011-no change	Cheese
Spaghetti with meatballs, canned	22912	Spaghetti, with meatballs in tomato sauce, canned	Analytical data, 2012	Pasta mixed dishes, excludes macaroni and cheese
Lasagna with meat, frozen	22916	Lasagna with meat and sauce, frozen entrée	Analytical data, 2012	Pasta mixed dishes, excludes macaroni and cheese
Chili with meat and beans, canned	22904	Chili con carne with beans, canned entree	Analytical data, 2011	Meat mixed dishes
Potato chips, unflavored	19411	Snacks, potato chips, plain, salted	Analytical data, 2013	Savory Snacks
Tortilla chips, unflavored	19056	Snacks, tortilla chips, plain, white corn, salted	Analytical data, 2013	Savory Snacks
Marinara sauce, ready to serve	06931	Sauce, pasta, spaghetti/marinara	Analytical data, 2011	Pasta Sauce, tomato based
Ranch dressing	04639	Salad dressing, ranch dressing, commercial, regular	Analytical data, 2013	Salad dressings and vegetable oils
Beef hotdog	07022	Frankfurter or hot dog, beef	Analytical data, 2013	Frankfurters
Flour tortilla	18364	Tortillas, ready-to-bake or -fry, flour, refrigerated	Analytical data, 2011	Tortilla
Biscuits, refrigerated dough	18014	Biscuits, plain or buttermilk, refrigerated dough, higher fat	Calculated by manufacturer, 2012	Biscuits, muffins, quick breads
Cheerios	08013	Cereals ready-to-eat, General Mills, Cheerios	Calculated by manufacturer, 2013	Ready-to-eat cereal
Frosted flakes	08069	Cereals ready-to- eat, Kellogg's, Frosted Flakes	from analytical, 2012	Ready-to-eat cereal
Raisin bran	08060	Cereals ready-to- eat, Kellogg's, Raisin Bran	Calculated by manufacturer, 2012	Ready-to-eat cereal

Abbreviations: SR 26: National Nutrient Database for Standard Reference, version 26, 2013; NDB#: The five-digit Nutrient Databank number uniquely representing the food in SR; WWEIA: What We Eat in America; NFP: Nutrition Facts Panel

What We Eat in America Food Categories. Available: http://www.ars.usda.gov/ba/bhnrc/fsrg.

Table 2

Comparison of sodium concentration (mg/100 g) of Sentinel Foods between CDC packaged food database and USDA National Nutrient Database for Standard Reference (SR 26)

	CDC Packaged food database				USDA SR26			Statistics	
Sentinel Food	**n**	**Range**	**Sodium mean± SE mg/100 g**	**CV SD/Mean *100**	**n**	**Range**	**Sodium mean ± SE mg/100 g**	**% Ratio***	**P value****
White bread	126	320–857	512±6	13%	19	410–555	491±10	96%	0.088
Hamburger roll	45	384–808	519±9	11%	12	451–580	500±10	96%	0.174
Ham, packaged and deli	52	811–1450	1157±19	12%	5	1090–1480	1314±150	114%	0.356
Cheese pizza, thin crust, frozen	21	382–689	479±16	16%	12	446–503	471±5	98%	0.644
Chicken nuggets, frozen	16	303–860	541±34	25%	17	496–719	552±8	102%	0.758
Chicken noodle soup, ready-to-eat	15	156–541	279±22	31%	10	272–338	306±8	110%	0.274
Chicken noodle soup, condensed	9	344–730	635±49	23%	0†	N/A†	677	107%	NA
Corn dog, frozen	13	397–742	680±24	13%	12	495–790	628±27	92%	0.161
American cheese	29	1223–1640	1329±22	9%	10	1230–1450	1272±16	96%	0.042
Cheddar cheese	93	571–705	629±10	4%	24	N/A	621±21	99%	0.802
Spaghetti with meatballs, canned	26	242–477	377±15	20%	18	203–435	315±5	84%	0.001
Lasagna with meat, frozen	20	212–423	350±11	14%	12	326–392	354±3	101%	0.733
Chili with meat and beans, canned	19	323–597	500±19	17%	11	442–500	449±6	90%	0.021
Potato chips, unflavored	31	194–1164	593±17	16%	5	342–575	450±94	76%	0.204
Tortilla chips, unflavored	41	23–821	427±10	16%	12	184–515	325±22	76%	0.001
Marinara sauce, ready to serve	85	179–675	449±10	21%	36	336–590	419±11	93%	0.052
Ranch dressing	53	476–1587	987±23	17%	18	810–1040	901±7	91%	0.001
Beef hotdog	68	683–1651	955±14	12%	18	860–1190	992±10	104%	0.036
Flour tortilla	63	463–952	733±21	23%	13	590–818	686±18	94%	0.096
Biscuit, refrigerated dough	100	806–1059	979±10	5%	2	943–1011	977	100%	NA
Cheerios	3	571–670	648±24	6%	0†	N/A†	497	77%	NA
Frosted flakes	4	449–472	463±3	2%	6	424–490	468±12	101%	0.714
Raisin bran	5	407–617	546±39	16%	0†	N/A†	356	65%	NA
Total	937				272				

Abbreviations: SE: standard error; CV: coefficient of variation; SD: standard deviation; N/A: not available

* % Ratio: (sodium value in SR/sodium value in Packaged food database)*100

** P-value based on T-test of the difference in mean sodium concentration between the specified food in the CDC Packaged food database versus USDA SR 26. P≤0.05 was considered statistically significant

† Sodium value not based on analytical data