RESEARCH
Research and Practice Innovations

Monitoring Sodium Intake of the US Population: Impact and Implications of a Change in What We Eat in America, National Health and Nutrition Examination Survey Dietary Data Processing

Rhonda S. Sebastian, MA; Cecilia Wilkinson Enns, MS, RD; Lois C. Steinfeldt, MPH; Joseph D. Goldman, MA; Alanna J. Moshfegh, MS, RD

ARTICLE INFORMATION

Article history:
Accepted 15 February 2013
Available online 6 April 2013

Keywords:
Sodium intake
Data comparability
What We Eat in America/National Health and Nutrition Examination Survey (WWEIA/NHANES)

Published by Elsevier Inc. on behalf of the Academy of Nutrition and Dietetics.
2212-2672/$0.00
doi: 10.1016/j.jand.2013.02.009

ABSTRACT

Accurate monitoring of US sodium intake requires familiarity with national dietary data collection and processing procedures. This article describes a data processing step that impacts sodium intake estimates, reasons for discontinuing the step, and implications of its discontinuation. This step, termed *salt adjustment*, was performed in US Department of Agriculture (USDA) dietary intake surveys from 1985 through 2008. In What We Eat in America (WWEIA), the dietary intake interview component of the National Health and Nutrition Examination Survey (NHANES), the salt content of specific foods was reduced on the basis of a question about household use of salt in cooking. For individuals whose households used salt in cooking occasionally or less often, some or all of the salt attributable to home preparation was removed from foods that typically have salt added during preparation and were obtained from the store. The growing availability of preprepared foods in stores challenges the validity of using store purchase as a proxy indicator of home food preparation, and increased restaurant/fast-food consumption implies fewer reported foods are eligible for the procedure. In addition, USDA's Automated Multiple-Pass Method for the 24-hour dietary recall provides accurate sodium intake estimates without applying the salt-adjustment step. The final WWEIA, NHANES data release to contain salt-adjusted sodium data was 2007-2008. When assessing the effectiveness of sodium-reduction efforts over time, the nutrition community (eg, researchers, analysts, providers) must be aware of this change in WWEIA, NHANES beginning in 2009-2010 and account for it using appropriate baseline estimates.
J Acad Nutr Diet. 2013;113:942-949.

AS DETERMINED BY THE COMMITTEE ON STRATEGIES to Reduce Sodium Intake, a group of experts convened by the Institute of Medicine at the request of Congress, achieving lower sodium intakes in the US population is a critical public health focus.[1] As such, it is of interest to a wide audience, including legislators, policymakers, program planners, dietetics practitioners, nutrition educators, and food manufacturers.

In order to track progress toward reducing sodium intake, accurate population estimates of sodium intake are essential. Nationally representative estimates of population intake of sodium (among other nutrients) are based on dietary intake data from What We Eat in America (WWEIA), the dietary intake interview component of the National Health and Nutrition Examination Survey (NHANES). To permit monitoring of sodium-reduction efforts, the committee recommended that "these surveys should continue to collect estimates of dietary sodium intake by multiple 24-hour recalls."[1]

WWEIA, NHANES is conducted as a partnership between the US Department of Agriculture (USDA) and the US Department of Health and Human Services.[2] Under this partnership, the USDA Food Surveys Research Group is responsible for the dietary data-collection methodology, maintenance of the databases used to code and process the data, and data review and processing.

Both the renewed focus on sodium and marketplace changes to the sodium content of foods have prompted the Food Surveys Research Group to review multiple aspects of WWEIA dietary data collection and processing related to sodium intake. One aspect of this review involved a data processing step referred to as "salt adjustment," which was applied during the processing of dietary intake data in all USDA nationwide food surveys since 1985 and in WWEIA, NHANES 2002 through 2008. Through the use of the salt-adjustment step, the amount of salt in eligible foods has been subject to reduction based on respondents' answers to questions about their use of salt in cooking. The findings presented in this article are a brief summary of the findings of the Food Surveys Research Group's review with regard to salt adjustment.[3,4]

After providing an overview of the process of salt adjustment, this report outlines the Food Surveys Research Group's rationale for discontinuing it and the subsequent analyses

conducted to document the impact of its discontinuation on sodium intake estimates. In addition, this article discusses the implications of this change for analysts monitoring progress toward the goal of reducing sodium intake in the United States, as well as for the nutrition community in general.

BACKGROUND

Dietary sodium comes from several sources. Some sodium is inherent in foods and water, but most sodium is consumed in the form of salt (sodium chloride). The sources of sodium intake in the United States, in order of predominance, are as follows: sodium added in food processing (77%), sodium inherent in foods (12%), salt added at the table (6%), salt added in cooking (5%), and sodium inherent in water (<1%).[5]

This report concerns only one of those sources, salt added during cooking or food preparation (hereafter referred to as "cooking" for brevity, even though some household food preparation involves no application of heat to food), because the salt-adjustment step was only applied to the amount of salt added in cooking. That salt is referred to as "optional salt." Salt adjustment did not affect the inherent sodium content of foods or the amount of sodium added during food processing. (Salting at the table has never been quantified in WWEIA.)

The practice of salt adjustment in USDA food surveys was instituted shortly after publication of the first edition of the Dietary Guidelines for Americans (DGA). At that time, the 1980 DGA advised consumers to "avoid too much sodium" through limiting the use of salt in cooking and at the table, avoiding excessive amounts of salty foods, and learning to read food labels.[6]

Salt adjustment is based on the assumption that when food is cooked at home, the cook or meal preparer controls the amount of salt added to the food, whereas someone outside the household controls the amount of salt in processed and restaurant foods. Originally, the idea behind the Food Surveys Research Group's use of the salt-adjustment step was to "give credit" to survey respondents who cooked specified foods without added salt.

The Figure outlines the implementation of salt adjustment in selected US nationwide surveys from 1985 through 2008. At first, salt adjustment was only applied to the intake of the person most responsible for household meals, and the only foods eligible for salt adjustment were those identified by the respondent as home-cooked items that were prepared without salt (Figure).

By the time of WWEIA, NHANES 2002-2008, several changes had occurred. Salt adjustment was applied to the intakes of all respondents, whether they were meal preparers or not. The only information that was available to determine whether a food was likely to have been cooked at home was whether it was obtained from a store rather than from any other venue (including restaurants, fast-food establishments, cafeterias, and other places). Instead of being asked whether salt was used in cooking specific foods, the respondent was asked a global question about the frequency of salt use in household cooking. For respondents who reported that their households cooked foods with salt only occasionally or less often, all of the respondent's eligible foods had their optional salt lowered. Eligible foods (ie, the types of food considered likely to have salt added in home preparation) were cooked cereals, rice, and pasta; eggs; potatoes, dry beans, and other vegetables; meat, poultry, and fish; and homemade mixed dishes, casseroles, stews, and soups. Foods likely to have been purchased in ready-to-eat form were not eligible for salt adjustment. For example, canned vegetables were not eligible for salt adjustment, but most fresh and frozen vegetables were eligible.

The baseline ("no adjustment") level of sodium per 100 g of food was the same as the level contained in the database used in coding dietary intakes and calculating nutrients for each survey. In WWEIA, NHANES 2007-2008, that database was the USDA Food and Nutrient Database for Dietary Studies version 4.1.[15] The underlying source of food composition data for the Food and Nutrient Database for Dietary Studies, including sodium values, is the USDA National Nutrient Database for Standard Reference[16] maintained by the USDA Nutrient Data Laboratory. The use of salt in widely available recipes for a multitude of foods, for example, eggs,[17] pasta,[18] rice,[19] and vegetables cooked from fresh form,[20] is accounted for in Food and Nutrient Database for Dietary Studies levels of salt.

In 2007-2008, 40% of respondents reported that salt was used "very often" in household cooking and food preparation; no adjustment was applied to reduce the optional salt content of any of the eligible foods they consumed. Thirty-seven percent of respondents reported that salt was used "occasionally" in household cooking or preparation; half the optional salt was removed from the eligible foods consumed by these individuals. The remaining respondents (24%) reported that salt was "rarely" or "never" used in cooking or food preparation in their households; all of the optional salt was removed from the eligible foods consumed by these individuals.

In the course of the Food Surveys Research Group's review of multiple aspects of WWEIA dietary data collection and processing related to sodium intake, a number of considerations called into question the value, as well as the validity, of continuing the salt-adjustment procedure. They include:

- The use of store purchase as a proxy indicator of home preparation is no longer appropriate. Both the range of stores that sell food and the availability of fully and partially prepared foods from those stores have dramatically increased.[21] In addition, the majority of retail prepared and ready-to-eat foods are bought at grocery stores.[22] If the criterion of being purchased from a store is no longer a good indicator that a food is home prepared and that the level of salt is at the discretion of the cook within the household, then continuing to apply the salt-adjustment step could lead to underestimation of total sodium intake.
- The proportion of foods obtained from restaurants and fast-food establishments has increased since the time when the salt-adjustment step was instituted.[23,24] Because salt adjustment applies only to foods likely to be cooked at home, the shift toward eating away from home implies that a lower proportion of food overall is eligible for salt adjustment.
- Many respondents lack knowledge about household food-preparation practices. Originally, only main meal-planners/preparers (see Figure, footnote a) answered questions about salt in home-prepared foods. This is no longer the case.
- 24-hour recall–based estimates of dietary intake with salt not adjusted compare favorably with estimates

Years	Survey name/acronym	Informant	Salt question and placement	Salt adjustment level(s)	Foods to which salt adjustment was applied
1985-1986	Continuing Survey of Food Intakes by Individuals[7]	Main meal-planner/preparer[a]	Placement: During the 24-hour recall: For each eating occasion with any food from the home food supply[b] Question: "Did you use salt or a salt substitute in preparing any of these items? During preparation, which foods/drinks did you use salt in and which ones did you use a salt substitute in?"	If no salt in cooking, removed all optional salt[c]	Only foods from the home food supply[b] that were specifically identified as being prepared without salt or with salt substitute
1994-1996, 1998	Continuing Survey of Food Intakes by Individuals[8]	Each respondent[d]	Placement: During the 24-hour recall: Question included in the Food Instruction Booklet for specific categories of foods Question: "Was salt used in cooking or preparing the (FOOD)?" Answer options were "don't know," "no salt," and "salt used."[e]	If no salt in cooking, removed all optional salt[c]	Only foods specifically identified as being prepared without salt, regardless of whether they were from the home food supply[b] or not
2002-2008	What We Eat in America, National Health and Nutrition Examination Survey[9-12]	Each respondent[d]	Placement: After the 24-hour recall Question: "How often is ordinary salt or seasoned salt added in cooking or preparing foods in your household? Is it never, rarely, occasionally, or very often?"	If rarely or never, removed all optional salt; if occasionally, removed half the optional salt[c]	Only foods purchased from the store and likely to be cooked at home

[a]Person in each household who was most responsible for planning and preparing the household's meals. Only this person's intake was eligible for salt adjustment.
[b]Foods and beverages from the home food supply are items that were either eaten at home or brought into the home but later eaten away from home.
[c]In the context of the salt-adjustment data-processing step, optional salt is the salt attributable to home cooking/preparation.
[d]Interviews were conducted for survey participants younger than age 6 y with a proxy who was generally the person most knowledgeable about the survey participant's intake. Child respondents ages 6 to 11 y were asked to provide their own food intake data assisted by an adult familiar with the child's intake. All respondents' intakes were eligible for salt adjustment.
[e]In the National Health and Nutrition Examination Survey (NHANES) 1999-2000, a similar question was asked with similar response options,[13] and Continuing Survey of Food Intakes by Individuals sodium data were used to modify sodium values when respondents specified that they did not use salt in preparation.[14] In 2001, before the full integration of What We Eat in America, NHANES, the method remained the same as in NHANES 1999-2000.

Figure. Process used by US Department of Agriculture to adjust optional salt in eligible foods: Selected US nationwide food surveys conducted in 1985-1986, 1994-1996, 1998, and 2002-2008.[7-12]

based on urinary sodium.[25] Using data from 472 subjects in the USDA Automated Multiple-Pass Method Validation Study who completed at least one 24-hour recall and collected a complete 24-hour urine corresponding to the dietary recall period, the validity of sodium intake as measured by the Automated Multiple-Pass Method was assessed. Automated Multiple-Pass Method–derived mean dietary sodium estimates reflected ≥90% of the biomarker-based estimates, demonstrating that the USDA Automated Multiple-Pass Method is a valid measure for estimating sodium intakes at the group level.[25]

On account of all of these considerations, the salt adjustment procedure was discontinued beginning in WWEIA, NHANES 2009-2010. The final data release to contain sodium data that were salt adjusted is WWEIA, NHANES 2007-2008.

Because of the multitude of applications for which WWEIA, NHANES dietary data are used, it is important to consider how large an impact the process of salt adjustment has had and what the ramifications of ceasing this data processing step will be.

METHODS

The impact of salt adjustment on mean estimates of sodium intake and on usual intakes relative to Dietary Reference Intakes was examined using dietary intake data of 8,529 respondents age 2 years and older from WWEIA, NHANES 2007-2008. One-sided *t* tests were used to test whether differences between mean sodium intake estimates calculated with and without salt adjustment were significantly different from zero. A significance level of $P<0.001$ was applied.

In order to assess intake of a nutrient relative to Dietary Reference Intakes, such as the Adequate Intake (AI) or the Tolerable Upper Intake Level (UL), usual intakes should be used.[26,27] The National Cancer Institute method[28] of calculating usual intakes was used to determine the impact of discontinuing salt adjustment on the proportion of the population meeting or exceeding their Dietary Reference Intakes for sodium.

Because the current study was a secondary analysis of publicly available data, no Institutional Review Board approval was necessary.

RESULTS

The effect of salt adjustment on 2007-2008 estimates of sodium intake is illustrated in Table 1. With salt adjustment, the estimated mean daily sodium intake for all individuals age 2 years and older in 2007-2008 was 3,330 mg. Without salt adjustment, it was 3,460 mg (ie, 3.9% higher). The pattern is similar across sex/age groups, and differences are statistically significant for all age groups ($P<.001$).

Similar patterns of differences between sodium intakes with and without salt adjustment were found across race/ethnicity and income groups (data not shown). For the inclusive group of individuals age 2 years and older in each of the race/ethnicity and income categories, mean daily sodium intakes were 3% to 4% higher without salt adjustment than with salt adjustment.[4]

Proportions of the population with intakes higher than the AI and UL for sodium with and without salt adjustment applied are presented in Table 2.

Even with salt adjustment, only ≤3% of individuals in any life stage group have intakes that do not exceed the AI. Therefore, it can be surmised that the prevalence of inadequate sodium intakes in the United States is most likely extremely low. Discontinuing the salt-adjustment procedure has little impact on this measure.

Given the nature of the concern about sodium and health in the United States (ie, the prevalence of high sodium intakes), the nutrition community will primarily be interested in the impact of discontinuing the salt-adjustment processing step on the proportion of the population with sodium intake higher than the UL. As shown in Table 2, the UL for sodium is exceeded by 88% of the population when salt adjustment is not conducted vs 84% when salt adjustment is conducted. For the 23 life-stage groups in Table 2, when the salt-adjustment step was performed on 2007-2008 intakes, the percentage of the group with intake higher than the UL ranged from 52% of women age 71 years and older to >97% of boys age 9 to 13 years and men age 19 to 50 years. When intakes for the same survey years were estimated without salt adjustment, the percentage of the group with intake higher than the UL was from 1 to 13 percentage points higher in all groups (except those that had already reached the highest level presented; ie, >97%). The largest difference was for women age 71 years and older.

CONCLUSIONS

Because of the importance of reducing sodium intake in the United States, there is intense interest in being able to monitor the success of sodium-reduction efforts by tracking consumption over time. Integral to the process of monitoring sodium intake are WWEIA, NHANES dietary data collected using USDA's 24-hour recall method (the Automated Multiple-Pass Method)[30] and database for coding dietary intake data and calculating nutrient intakes (the Food and Nutrient Database for Dietary Studies).[15]

Adjustment of salt levels in home-prepared foods consumed by individuals who said their households cooked with salt only occasionally or less often was once considered a useful way to make sodium intake estimates more reflective of actual intakes. Although the addition of salt in food preparation is a factor in sodium intake, it is a very minor one compared with the use of processed food. Changes in food-preparation practices over time call into question one of the assumptions on which the salt-adjustment process was founded, namely, that individuals have control over the salt content of home-prepared food. Current survey respondents may or may not be knowledgeable about cooking practices within their homes. Without application of the salt-adjustment step, the Automated Multiple-Pass Method produces sodium intake estimates that compare favorably with estimates based on urinary sodium.[25] For these reasons, the process of adjusting optional salt in eligible foods is being discontinued in WWEIA, NHANES 2009-2010 and all subsequent surveys. This change's implications for accurate monitoring of sodium intake should be noted not only by researchers, but also by the nutrition community in general.

Applications for Analysts

Sodium intake estimates calculated without the salt-adjustment step are about 4% higher than estimates calculated with the step. In order to be able to track the success of efforts to reduce US intake of sodium, analysts must use appropriate baseline estimates calculated in a manner comparable with the new estimates (ie, without the salt-adjustment processing step). Failure to use comparable baseline estimates could result in spurious findings of a lack of effect of sodium-reduction strategies.

This report provides baseline estimates without salt adjustment for 2007-2008 in Table 1. In addition, tables are provided on the Food Surveys Research Group website displaying adjusted and unadjusted WWEIA, NHANES 2007-2008 sodium intake estimates by sex and age, race/ethnicity, and in-

Table 1. Sodium intakes from food: Comparison of mean daily amount (mg) with and without salt adjustment, by sex and age, What We Eat in America, National Health and Nutrition Examination Survey 2007-2008, 1 day

		Mean Daily Sodium Intake (mg)					
		With Salt Adjustment		Without Salt Adjustment[c]			
Sex and age (y)[a]	Sample size	Mean	SE[b]	Mean	SE	Difference[d]	Relative difference[e] (%)
Males							
2-5	455	2,265	39.5	2,339	44.7	73	3.2
6-11	550	3,169	104.4	3,238	104.9	69	2.2
12-19	607	3,990	129.2	4,093	131.1	103	2.6
20-29	409	4,363	174.1	4,561	184.2	198	4.5
30-39	451	4,231	89.3	4,382	89.5	151	3.6
40-49	412	4,391	156.9	4,591	159.2	200	4.6
50-59	431	4,030	175.9	4,207	175.7	177	4.4
60-69	459	3,517	123.1	3,678	128.3	161	4.6
70 and older	500	3,012	116.8	3,215	117.7	203	6.7
20 and older	2,662	4,043	80.3	4,224	81.3	182	4.5
Females							
2-5	377	2,189	67.4	2,251	67.7	62	2.8
6-11	571	2,717	95.9	2,802	95.4	85	3.1
12-19	549	3,013	143.6	3,096	137.3	83	2.8
20-29	409	3,009	119.6	3,107	118.3	99	3.3
30-39	482	3,058	154.7	3,161	161.6	103	3.4
40-49	466	3,027	121.4	3,143	132.2	116	3.8
50-59	413	2,936	105.9	3,031	108.3	96	3.3
60-69	465	2,674	71.6	2,795	70.9	121	4.5
70 and older	523	2,364	57.5	2,543	58.8	179	7.6
20 and older	2,758	2,884	40.1	3,000	42.7	115	4.0
Males and females							
2 and older	8,529	3,330	52.1	3,460	54.1	130	3.9

[a]Excludes breastfed children.
[b]SE=standard error.
[c]For each sex/age group, sodium mean without salt adjustment differs significantly from sodium mean with salt adjustment ($P<0.001$).
[d]Calculated as sodium mean without salt adjustment−sodium mean with salt adjustment.
[e]Calculated as [(sodium mean without salt adjustment−sodium mean with salt adjustment)÷sodium mean with salt adjustment]×100.

come, along with 2009-2010 estimates calculated in the new manner (ie, without the salt-adjustment procedure).[4]

For researchers who wish to conduct their own analyses of WWEIA, NHANES data for any survey cycle up to 2007-2008, sodium values provided in the version of the Food and Nutrient Database for Dietary Studies corresponding to the relevant survey data release can be used to recalculate total sodium intakes for the population(s) of interest.

Application for the Nutrition Community in General

In order to knowledgeably evaluate reports concerning changes in sodium intake over time, the nutrition community should be aware that estimates of US sodium intake in 2007-2008 or earlier calculated *without* the salt-adjustment step are the proper basis for comparison with 2009-2010 or later values. This article and the Food Surveys Research Group website[3] provide such estimates to enable readers to assess the soundness of analyses about changes in sodium intake.

Ongoing USDA Strategies to Provide Accurate Sodium Data

In consideration of the need to continue providing accurate estimates of sodium intake to measure progress toward public health goals, a number of additional efforts are underway. The Food Surveys Research Group and the Nutrient Data Laboratory have collaborated in identifying processed foods fre-

Table 2. Percentages of the population with usual intake[a] of sodium[b] above Adequate Intakes and Tolerable Upper Intake Levels,[c] with and without salt adjustment, What We Eat in America, National Health and Nutrition Examination Survey 2007-2008

		With Salt Adjustment						Without Salt Adjustment					
Life stage[d] group (y)	Sample size	AI[e] (mg)	% Above AI[f]	SE[g]	UL[h] (mg)	% Above UL[f]	SE	AI (mg)	% Above AI[f]	SE	UL (mg)	% Above UL[f]	SE
Males													
1-3	383	1,000	>97		1,500	77	5.8	1,000	>97		1,500	82	5.2
4-8	502	1,200	>97		1,900	86	3.1	1,200	>97		1,900	87	2.9
9-13	412	1,500	>97		2,200	>97		1,500	>97		2,200	>97	
14-18	380	1,500	>97		2,300	94	2.6	1,500	>97		2,300	95	2.6
19-30	518	1,500	>97		2,300	>97		1,500	>97		2,300	>97	
31-50	890	1,500	>97		2,300	>97		1,500	>97		2,300	>97	
19-50	1,408	1,500	>97		2,300	>97		1,500	>97		2,300	>97	
51-70	869	1,300	>97		2,300	93	2.0	1,300	>97		2,300	96	1.5
71 and older	466	1,200	>97		2,300	82	4.5	1,200	>97		2,300	89	2.9
51 and older	1,335	—[i]	>97		2,300	91	1.9	—[i]	>97		2,300	94	1.4
19 and older	2,743	—[i]	>97		2,300	95	0.6	—[i]	>97		2,300	97	0.5
Females													
1-3	349	1,000	97	2.4	1,500	76	4.5	1,000	>97		1,500	80	4.5
4-8	435	1,200	>97		1,900	80	3.8	1,200	>97		1,900	83	3.7
9-13	418	1,500	>97		2,200	89	5.2	1,500	>97		2,200	93	4.3
14-18	339	1,500	>97		2,300	74	6.8	1,500	>97		2,300	76	6.1
19-30	456	1,500	>97		2,300	82	6.2	1,500	>97		2,300	85	6.3
31-50	914	1,500	97	1.2	2,300	77	2.9	1,500	>97		2,300	80	3.5
19-50	1,370	1,500	>97		2,300	79	2.9	1,500	>97		2,300	82	3.1
51-70	872	1,300	>97		2,300	75	2.8	1,300	>97		2,300	81	2.8
71 and older	484	1,200	>97		2,300	52	4.4	1,200	>97		2,300	65	4.3
51 and older	1,356	—[i]	>97		2,300	69	2.5	—[i]	>97		2,300	77	2.4
19 and older	2,726	—[i]	>97		2,300	75	2.3	—[i]	>97		2,300	80	2.5
Males and females													
1 and older	8,687	—[i]	>97		—[i]	84	1.4	—[i]	>97		—[i]	88	1.4

[a]The method used to estimate the usual nutrient intake distributions presented in this table was developed by the National Cancer Institute. An overview of the general method and the procedure for usual intake estimation is available from reference 28, appendix C, "Procedure for Usual Intake Estimation."
[b]Sodium intake estimates include sodium that occurs naturally in food and beverages (including drinking water) and salt added during food processing and cooking or food preparation. Excluded are salt added at the table and sodium contributed by dietary supplements and medications.
[c]For definitions of Adequate Intakes and Tolerable Upper Intake Levels, see reference 29.
[d]Excludes breastfed children and pregnant or lactating females. Age groups in this table are based on those used in Dietary Reference Intake (DRI) reports.
[e]AI=Adequate Intake.
[f]Percentages >97% are represented by >97. Standard errors are not displayed in these cases.
[g]SE=standard error.
[h]UL=Tolerable Upper Intake Level.
[i]Estimates of percentages greater than the DRI and standard errors of the percentages are the direct result of an estimation of the usual nutrient intake distribution for that specific life stage group. Exceptions were necessary for composite groups where the DRI value differs across the component groups. For these groups, the estimated percentage greater than the DRI value was computed as an average of the percentages for the sex/age subgroups comprising the composite group, weighted proportionally by population size. Because a single DRI value for these composite groups does not exist, a dash is displayed.

quently reported in WWEIA, NHANES for analysis of their nutrient composition, including sodium. These foods have been sampled from across the country, from both retail stores and popular restaurants, so as to provide nutrient data that are more representative of the foods consumed. The new composition data will be disseminated, as usual, in successive releases of the National Nutrient Database for Standard Reference and the Food and Nutrient Database for Dietary Studies. The Food Surveys Research Group is also reviewing survey methodology to enhance dietary reporting of sodium. Each year, the Automated Multiple-Pass Method is updated to assure that questions and response options elicit the necessary details about foods reported by survey respondents. During the past few years, the Automated Multiple-Pass Method updates have increasingly focused attention on sodium, as well as on food reformulations (including fortification and incorporation of whole grains). The recipes that make up the foods in the Food and Nutrient Database for Dietary Studies also undergo continual review and updating to accurately reflect the most common current food-preparation practices. All of these efforts support the ongoing assessment of US sodium intake.

References

1. Institute of Medicine Committee on Strategies to Reduce Sodium Intake. Strategies to Reduce Sodium Intake in the United States. In: Henney JE, Taylor CL, Boon CS, eds. Washington, DC: National Academies Press; 2010. http://www.nap.edu/catalog.php?record_id=12818. Accessed November 27, 2012.
2. National Health and Nutrition Examination Survey 2009-2010 Data Documentation, Codebook, and Frequencies: Dietary Interview (DRXDOC_F). Hyattsville, MD: Centers for Disease Control and Prevention, National Center for Health Statistics; 2012. http://www.cdc.gov/nchs/nhanes/nhanes2009-2010/DRXDOC_F.htm. Accessed November 27, 2012.
3. Sebastian RS, Wilkinson Enns C, Steinfeldt LC, Goldman JD, Moshfegh AJ. Discontinuation of Data Processing Step: Salt Adjustment on Designated Foods Likely To Be Home Prepared. Beltsville, MD: US Department of Agriculture, Food Surveys Research Group; 2012. http://www.ars.usda.gov/SP2UserFiles/Place/12355000/pdf/0910/discontinuation%20of%20data%20processig%20step-salt%20adjustment.pdf. Accessed November 27, 2012.
4. Sodium Intake Reassessed for 2007-2008: Result of Discontinuation of Data Processing Step on Salt Adjustment, Mean Amounts Consumed per Individual, in the United States, 2007-2008 and 2009-2010. Beltsville, MD: US Department of Agriculture, Agricultural Research Service; 2012. http://www.ars.usda.gov/SP2UserFiles/Place/12355000/pdf/0910/sodium%20intake%20reassessed%20for%202007-2008.pdf. Accessed November 27, 2012.
5. Mattes RD, Donnelly D. Relative contributions of dietary sodium sources. *J Am Coll Nutr*. 1991;10(4):383-393.
6. Nutrition and Your Health: Dietary Guidelines for Americans. Washington, DC: US Department of Agriculture; 1980. (Home and Garden Bulletin No. 232). Co-published by US Department of Health, Education, and Welfare. http://www.cnpp.usda.gov/Publications/DietaryGuidelines/1980/DG1980pub.pdf. Accessed November 27, 2012.
7. Continuing Survey of Food Intakes by Individuals (CSFII): One Day's Food Intake Data for Women [19-50 Years] and Their Children 1-5 Years of Age, 1985 [dataset documentation]. Hyattsville, MD: US Department of Agriculture; 1986. (NTIS no. PB86-170990). http://www.ars.usda.gov/SP2UserFiles/Place/12355000/pdf/8586/csfii85_1day_doc.pdf. Accessed March 14, 2013.
8. Tippett KS, Cypel YS, eds. *Design and Operation: The Continuing Survey of Food Intakes by Individuals and the Diet and Health Knowledge Survey, 1994-96*. Riverdale, MD: US Department of Agriculture, Agricultural Research Service; 1997. Nationwide Food Surveys Report No. 96-1. (NTIS no. PB98-137268). http://www.ars.usda.gov/SP2UserFiles/Place/12355000/pdf/Dor9496.pdf. Accessed March 15, 2013.
9. National Health and Nutrition Examination Survey 2001-2002 Data Documentation, Codebook, and Frequencies: Dietary Interview—Individual Foods File (DRXIFF_B). Hyattsville, MD: Centers for Disease Control and Prevention, National Center for Health Statistics; 2004 [rev. 2010]. http://www.cdc.gov/nchs/nhanes/nhanes2001-2002/DRXIFF_B.htm. Accessed March 15, 2013.
10. National Health and Nutrition Examination Survey 2003-2004 Data Documentation, Codebook, and Frequencies: Dietary Interview—Individual Foods, First Day (DR1IFF_C). Hyattsville, MD: Centers for Disease Control and Prevention, National Center for Health Statistics; 2006 [revised 2007]. http://www.cdc.gov/nchs/nhanes/nhanes2003-2004/DR1IFF_C.htm. Accessed March 15, 2013.
11. National Health and Nutrition Examination Survey 2005-2006 Data Documentation, Codebook, and Frequencies: Dietary Interview (DRXDOC_D). Hyattsville, MD: Centers for Disease Control and Prevention, National Center for Health Statistics; 2008. http://www.cdc.gov/nchs/nhanes/nhanes2005-2006/DRXDOC_D.htm. Accessed March 15, 2013.
12. National Health and Nutrition Examination Survey 2007-2008 Data Documentation, Codebook, and Frequencies: Dietary Interview (DRXDOC_E). Hyattsville, MD: Centers for Disease Control and Prevention, National Center for Health Statistics; 2010. http://www.cdc.gov/nchs/nhanes/nhanes2007-2008/DRXDOC_E.htm. Accessed March 15, 2013.
13. National Health and Nutrition Examination Survey 1999-2000 Dietary Interviewer Procedure Manual. Hyattsville, MD: US Department of Health and Human Services, Centers for Disease Control and Prevention; 1999 [revised 2000]. Chapter 6, Conducting the Automated 24-Hour Recall. http://www.cdc.gov/nchs/data/nhanes/dr-6.pdf. Accessed November 27, 2012.
14. National Health and Nutrition Examination Survey 1999-2000 Data Documentation, Codebook, and Frequencies: Dietary Interview (Individual Foods File) (DRXIFF). Hyattsville, MD: US Department of Health and Human Services, Centers for Disease Control and Prevention; 2002 [revised 2010]. http://www.cdc.gov/nchs/nhanes/nhanes1999-2000/DRXIFF.htm#Data_Processing_and_Editing. Accessed November 27, 2012.
15. Food and Nutrient Database for Dietary Studies. Beltsville, MD: US Department of Agriculture, Food Surveys Research Group; 2012. http://www.ars.usda.gov/Services/docs.htm?docid=12089. Accessed November 27, 2012.
16. US Department of Agriculture National Nutrient Database for Standard Reference, Release 24. Beltsville, MD: US Department of Agriculture, Agricultural Research Service; 2011. http://www.ars.usda.gov/ba/bhnrc/ndl. Accessed November 27, 2012.
17. Deen P. Omelette for a crowd recipe. Food Network. http://www.foodnetwork.com/recipes/paula-deen/omelette-for-a-crowd-recipe2/index.html. Accessed November 27, 2012.
18. Oliver J. Simple summer spaghetti. http://www.jamieoliver.com/recipes/pasta-recipes/simple-summer-spaghetti. Accessed November 27, 2012.
19. Lagasse E. Cilantro-lime rice recipe. Cooking Channel. http://www.cookingchanneltv.com/recipes/emeril-lagasse/cilantro-lime-rice-recipe/index.html. Accessed November 27, 2012.
20. Ray R. Baby carrots recipe. Food Network. http://www.foodnetwork.com/recipes/rachael-ray/baby-carrots-recipe/index.html. Accessed November 27, 2012.
21. Food Retailing in the 21st Century—Riding a Consumer Revolution. Arlington, VA: Food Marketing Institute; 2007. (FMI Backgrounder). http://www.fmi.org/docs/media-backgrounder/foodretailing.pdf?sfvrsn=2. Accessed November 27, 2012.
22. Irwin T. Supermarkets aren't just for groceries anymore. *Marketing Daily*. July 23, 2012. http://www.mediapost.com/publications/article/179248/supermarkets-arent-just-for-groceries-anymore.html#axzz2DSrJ2fMu. Accessed November 27, 2012.
23. Nutrient Intakes: Individuals in 48 States, Year 1977-78. Hyattsville, MD: US Department of Agriculture, Human Nutrition Information Service; 1984. (NFCS Rep. I-2). Table 5A, Nutritive contribution of food obtained and eaten away from home percentage of nutrient intake per individual per day, 1977-1978, p. 282. http://www.ars.usda.gov/SP2UserFiles/Place/12355000/pdf/7778/nfcs7778_rep_i-2.pdf. Accessed November 27, 2012.
24. Rhodes DG, Clemens JC, Adler ME, Moshfegh AJ. Nutrient intakes from restaurants: What We Eat in America, 2007–2008 [abstract]. FASEB J. 2012;26:1005.1. http://www.fasebj.org/cgi/content/meeting_abstract/26/1_MeetingAbstracts/1005.1?sid=f9e4%207c50-1f4d-4548-a28d-cf8f9921c752. Accessed November 27, 2012.

25. Rhodes DG, Murayi T, Clemens JC, Baer DJ, Sebastian RS, Moshfegh AJ. The US Department of Agriculture Automated Multiple-Pass Method accurately assesses population sodium intakes. *Am J Clin Nutr*. 2013. In press.

26. Barr SI, Murphy SP, Poos MI. Interpreting and using the dietary references intakes in dietary assessment of individuals and groups. *J Am Diet Assoc*. 2002;102(6):780-788.

27. Institute of Medicine. Food and Nutrition Board. *Dietary Reference Intakes: Applications in Dietary Assessment*, Washington, DC: National Academies Press; 2000. http://www.nap.edu/catalog.php?record_id=9956. Accessed November 27, 2012.

28. Moshfegh A, Goldman J, Ahuja J, Rhodes D, LaComb R. What We Eat in America, NHANES 2005-2006: Usual Nutrient Intakes From Food and Water Compared to 1997 Dietary Reference Intakes for Vitamin D, Calcium, Phosphorus, and Magnesium. Beltsville, MD: US Department of Agriculture, Agricultural Research Service; 2009. http://www.ars.usda.gov/SP2UserFiles/Place/12355000/pdf/0506/usual_nutrient_intake_vitD_ca_phos_mg_2005-06.pdf. Accessed November 27, 2012.

29. Institute of Medicine, Food and Nutrition Board. Dietary Reference Intakes for Water, Potassium, Sodium, Chloride, and Sulfate. Washington, DC: National Academies Press; 2005. http://www.nap.edu/catalog.php?record_id=10925. Accessed November 27, 2012.

30. Moshfegh AJ, Rhodes DG, Baer DJ, 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(2):324-332. http://www.ajcn.org/content/88/2/324.full.pdf. Accessed November 27, 2012.

AUTHOR INFORMATION

R. S. Sebastian, C. Wilkinson Enns, and L. C. Steinfeldt are nutritionists, J. D. Goldman is a mathematical statistician, and A. J. Moshfegh is a research leader, US Department of Agriculture, Agricultural Research Service, Food Surveys Research Group, Beltsville, MD.

Address correspondence to: Rhonda S. Sebastian, MA, US Department of Agriculture, Agricultural Research Service, Food Surveys Research Group, 10300 Baltimore Ave, Bldg 005, Room 102, BARC-West, Beltsville, MD 20705-2350. E-mail: Rhonda.Sebastian@ars.usda.gov

STATEMENT OF POTENTIAL CONFLICT OF INTEREST

No potential conflict of interest was reported by the authors.

FUNDING/SUPPORT

There is no funding to disclose.