RESEARCH
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Updated Nutrition Standards Have Significantly Improved the Nutritional Quality of School Lunches and Breakfasts

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ABSTRACT

Background Implementation of updated nutrition standards for school meals began during school year (SY) 2012-2013. The standards were designed to improve the nutritional quality of the meals and their consistency with the Dietary Guidelines for Americans.

Objective To assess the nutritional quality of school lunches and breakfasts after the updated standards were in place and compare it with the nutritional quality of the meals before the updated standards.

Design School menu data were used from two cross-sectional, nationally representative studies of schools participating in the National School Lunch Program during SY 2014-2015 (School Nutrition and Meal Cost Study) and SY 2009-2010 (fourth School Nutrition Dietary Assessment Study).

Participants/setting The analysis used 1 week of school menu data from 1,206 schools at lunch and 1,110 schools at breakfast for SY 2014-2015, and 884 schools at lunch and 802 schools at breakfast for SY 2009-2010.

Outcome measures Healthy Eating Index 2010 scores were estimated.

Statistical analyses Descriptive analyses were conducted to estimate mean Healthy Eating Index 2010 total and component scores for school meals. Scores are expressed as a percentage of maximum possible scores. Two-tailed *t* tests were used to assess differences in scores before and after updated standards were in place.

Results Total Healthy Eating Index 2010 scores for school lunches and breakfasts increased significantly after the updated standards. Between SY 2009-2010 and SY 2014-2015, the total score for school lunches increased from 58% of the maximum score to 82%, and the total score for school breakfasts increased from 50% to 71% ($P<0.05$). For both meals, component scores increased by more than 20 percentage points for whole grains, refined grains, and empty calories, as well as for greens and beans for lunches and whole fruit and sodium for breakfasts.

Conclusions The updated nutrition standards for schools meals significantly improved the nutritional quality of the meals and their consistency with the Dietary Guidelines for Americans.

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THE NATIONAL SCHOOL LUNCH PROGRAM (NSLP) AND School Breakfast Program (SBP) provide low-cost or free meals to students attending public or nonprofit private schools.[1,2] On an average day in school year (SY) 2017-2018, 30 million children ate a school lunch and 15 million ate a school breakfast.[3,4] The overarching goal of both programs, known collectively as the school meal programs, is to ensure that children do not go hungry and have access to nutritious meals that promote their health, well-being, and academic achievement.[5]

The Healthy, Hunger-Free Kids Act of 2010 (HHFKA) mandated major reforms in the school meal programs, including updated nutrition standards for the meals.[5] HHFKA directed the US Department of Agriculture (USDA) to update the nutrition standards to better align the meals with the most recent recommendations in the Dietary Guidelines for Americans (DGA) and improve the overall nutritional quality of the meals.[6,7] The standards USDA developed were based on recommendations from an expert committee commissioned by the Institute of Medicine (now the National Academy of Medicine).[8] Relative to the prior standards, which had

been in place since 1995, the updated standards increased the availability of fruits, vegetables, and whole grains; limited milk to fat-free and low-fat varieties; reduced the levels of sodium and saturated fat; eliminated synthetic forms of *trans* fat; and, for the first time, specified both minimum and maximum levels of energy for the meals.[6] In addition, the updated standards require that students select at least one-half cup of fruits or vegetables in their meal. These changes were expected to improve the quality of students' diets and overall health and address concerns about increasing levels of childhood obesity.[6]

Implementation of the updated standards was a gradual process that began in SY 2012-2013.[6] Starting in SY 2014-2015, school meals were expected to meet all the updated requirements for both lunches and breakfasts.[6] It is important to assess whether the updated standards were successful in improving the nutritional quality of school meals and their consistency with the DGA. Some studies have documented improvements in the types and quality of foods included in school meals and in their nutrient content.[9-18] However, all these studies were based on small, local samples, and many focused only on specific school levels (such as elementary or middle schools). This article uses data from nationally representative samples of schools to assess the nutritional quality of school meals served in SY 2014-2015, after the updated standards were in place, and compare the nutritional quality of school meals before and after the standards were in place.

RESEARCH SNAPSHOT

Research Question: Did the updated nutrition standards improve the nutritional quality of school meals?

Key Findings: Based on data from two cross-sectional, nationally representative studies, the nutritional quality of school lunches and breakfast, as measured by Healthy Eating Index 2010, increased significantly after the updated nutrition standards were in place.

MATERIALS AND METHODS

School menu data from SY 2014-2015 were used to assess the nutritional quality of meals after the updated standards were in place. These data were collected as part of the School Nutrition and Meal Cost Study (SNMCS), which was funded by USDA's Food and Nutrition Service and examined a broad array of other topics, including the school food environment, student participation and dietary intakes, plate waste, and the cost of producing school meals.[19-23] The study was designed to provide estimates that were representative of all public, noncharter schools that participated in the NSLP. The study used a two-stage sampling approach to select nationally representative samples of public school food authorities and public noncharter schools in the 48 contiguous United States and the District of Columbia that participated in the NSLP. In total, 548 school food authorities were recruited to participate, and one to six schools of varying school levels were sampled in each. A total of 1,248 schools agreed to participate in the study. Data were collected during the spring semester (January through June) of SY 2014-2015. The Office of Management and Budget and the New England Institutional Review Board approved the study protocol. School districts with their own review boards approved the protocol for local data collection. Additional details on the design of the study are available elsewhere.[19]

School Menu Data Collection and Processing

One week of school lunch and breakfast menu data were collected using an online menu survey. In most cases, school nutrition managers completed the menu survey for their school; however, for some schools, staff at the district level completed the survey. Online training videos provided detailed instructions on how to complete the menu survey, and instructions were also embedded on each page. Respondents reported detailed information on all foods and beverages served in reimbursable lunches and breakfasts on each school day of the target week, including food details needed for an accurate nutrient analysis, portion sizes, recipes, and the number of portions served to or selected by students in reimbursable meals. Before and during the week of data collection, trained technical assistants encouraged completion of the menu survey and were available to answer questions. Respondents who were unable or unwilling to complete the menu survey online were mailed a paper version. Upon completion of the menu surveys, trained staff reviewed the data and followed-up with respondents to retrieve missing data or clarify inconsistent data. The final sample included 1,206 schools with complete data for school lunches, for a weighted response rate of 96.2%. Of these schools, 1,110 also participated in the SBP and provided complete data for school breakfasts.

Foods reported on each school's daily lunch and breakfast menus during the target week were entered into USDA's SurveyNet system to obtain data on energy and nutrient content from the Food and Nutrient Database for Dietary Studies version 2011-2012 (FNDDS).[24] Foods were subsequently linked to USDA's Food Patterns Equivalents Database version 2011-2012 to obtain data on the amounts of dietary components represented in the USDA Food Patterns (referred to as food groups).[25] During data entry and processing, special procedures were used to ensure that the nutrient and food group content of the foods served in school menus was accurately estimated. Some database recipes in FNDDS were modified to reflect more accurately the types and amounts of ingredients used in school recipes. Recipe modifications were targeted to those that would affect the fat, whole-grain, or sodium content of the menu item, and entrée items (such as sandwiches, Mexican entrées, and salads) where database recipes in FNDDS differed considerably in the types and amounts of ingredients relative to those typically used in schools. USDA Food Pattern food group data were subsequently constructed for recipe modifications using ingredient-level data for the modified food and the Food Patterns Equivalents Ingredient Database version 2011-2012.[26] Last, nutrient and food group profiles for specially formulated school food products were imputed by USDA's Agricultural Research Service. These foods are manufactured specifically for school foodservice—for example, to contain more whole grains or less saturated fat or sodium—and were not well represented in the USDA databases.

After the food-level data were finalized, the nutrient and food group content of daily lunch and breakfast menus was

constructed to reflect the actual foods that students selected (or were served) as part of their school meals. Nutrient and food group data for each food were weighted by the number of students that selected the food. These nutrient and food group values were then summed across all foods per menu day and divided by the number of students that had a school lunch or breakfast. The resulting estimates of the nutrient and food group content of the meals selected by students give greater weight to the foods that were selected more frequently in the meals. This may differ from the nutrient and food group content of the meals offered to students, given that schools often offer students choices between several options (eg, a choice between two types of milk or among three entrée items) and, in most schools, students are not required to take all of the meal components offered to them. The nutrient and food group estimates for each menu day were then averaged over the school week to estimate the nutrient and food group content of the average school lunch and breakfast selected by students.

School menu data from the fourth School Nutrition Dietary Assessment (SNDA-IV) study were used to compare the nutritional quality of school meals before and after the updated standards were in place. The SNDA-IV study was the latest national evaluation of the school meal programs before the updated standards took effect.[27] This study, which was also funded by USDA's Food and Nutrition Service, collected data from a nationally representative sample of schools in SY 2009-2010. Comparable procedures were used in both studies to sample school food authorities and schools and collect and process school menu data.[27] The final sample for the SNDA-IV study included 884 schools with complete data for school lunches, for a weighted response rate of 97.7%.[27] Of these schools, 802 also participated in the SBP and provided complete data for school breakfasts.

Estimating Healthy Eating Index 2010 Scores

The nutritional quality of school meals was examined using the Healthy Eating Index 2010 (HEI-2010), which assesses the degree to which a set of foods aligns with recommendations of the 2010 DGA.[28] The HEI is widely used for measuring nutritional quality and has a number of valuable applications, including examining the quality of foods or meals provided through federal nutrition programs like the NSLP and SBP.[28-31] The HEI is updated to correspond to each new release of the DGA. The HEI-2010 was used for the analysis because the 2010 DGAs were in place when data for the SNMCS were collected, and it was the most recent iteration of the HEI available at the time of analysis.[31]

The HEI-2010 is composed of nine adequacy components and three moderation components, each of which measures conformance with different aspects of the DGA (Table 1).[32] Each component is assigned a weight, referred to as the maximum possible score, to establish an appropriate balance among the components and to derive a total score.[28] As shown in Table 1, each component has a standard for achieving the maximum possible score, as well as a standard for receiving the minimum score of zero. The standards, which are based on the USDA Food Patterns in the DGA, are expressed as densities (typically the amount of a dietary component per 1,000 kcal).[28] The use of the density-based standards allows the assessment of quality to be separate from quantity.[28] For school meals, this means that higher scores cannot be achieved by simply serving larger portions of food—the amounts must be balanced with the level of energy in the meals. Densities between the minimum and maximum standards are scored proportionately.[28] Scores for each component are summed to construct the total HEI-2010 score, which has a maximum possible score of 100.[28] Higher scores for each component and for the total score indicate higher nutritional quality and better conformance with DGA recommendations.[28] Mean HEI-2010 scores were estimated based on each school's average lunch and breakfast served using the simple HEI scoring algorithm method and publicly available SAS programs and macros.[33,34]

Statistical Analysis

The analyses used school-level weights that accounted for each study's complex sample design and nonresponse. Additional details on analysis weights are available elsewhere.[19,27] To test for differences in mean HEI-2010 scores before (SY 2009-2010) and after (SY 2014-2015) the updated standards were in place, two-tailed t tests were used and a level of $P<0.05$ was used to determine statistical significance. All analyses were performed using SAS statistical software.[34]

To aid in the interpretation of the mean HEI-2010 scores in terms of adherence to the DGA, the scores for school lunches and breakfasts are expressed as the percentage of the maximum possible score [(mean/maximum score) $\times$ 100]. Higher percentages for each component and for the total score indicate healthier meals and better conformance with DGA recommendations.

RESULTS

School Lunches

The mean total HEI-2010 score for school lunches served in SY 2014-2015 was 82% of the maximum possible score (Table 2). School lunches received near-perfect scores (defined as 95% of the maximum possible score or higher) for four of the adequacy components—total fruit, whole fruit, whole grains, and dairy. The score for total protein foods was slightly lower (90%) and was followed by scores for total vegetables, greens and beans, fatty acids, and seafood and plant proteins. Among the moderation components, school lunches served in SY 2014-2015 received near-perfect scores of 96% of the maximum for both empty calories and refined grains. The score for sodium was much lower, at 27% of the maximum.

The total HEI-2010 score for school lunches increased significantly between SY 2009-2010—when the former nutrition standards were in place—and SY 2014-2015, when the updated standards were in place (Figure 1). The total score increased from 58% of the maximum possible score to 82%. Scores for 10 of the 12 HEI-2010 components increased significantly. The largest increases were for whole grains and greens and beans. The score for whole grains increased from about one-fourth of the maximum score (25%) to a near-perfect score of 95%. The score for greens and beans increased from 21% of the maximum to 72%. For two of the moderation components—refined grains and sodium—scores more than doubled, indicating a decrease in concentrations of these components over time.

Table 1. Healthy Eating Index 2010 components and standards for scoring[32]

Components	Maximum score	Standard for maximum score[a]	Standard for minimum score[a]
Adequacy components[b]			
Total fruit[c]	5	≥ 0.8 c equivalent/1,000 kcal	No fruit
Whole fruit[d]	5	≥ 0.4 c equivalent/1,000 kcal	No whole fruit
Total vegetables[e]	5	≥ 1.1 c equivalent/1,000 kcal	No vegetables
Greens and beans[e]	5	≥ 0.2 c equivalent/1,000 kcal	No dark green vegetables, beans, or peas
Whole grains	10	≥ 1.5 oz equivalent/1,000 kcal	No whole grains
Dairy[f]	10	≥ 1.3 c equivalent/1,000 kcal	No dairy
Total protein foods[g]	5	≥ 2.5 oz equivalent/1,000 kcal	No protein foods
Seafood and plant proteins[gh]	5	≥ 0.8 oz equivalent/1,000 kcal	No seafood or plant proteins
Fatty acids[i]	10	(PUFAs[j] + MUFAs[k])/SFAs[l] ≥2.5	(PUFAs + MUFAs)/SFAs ≤1.2
Moderation components[m]			
Refined grains	10	≤1.8 oz equivalent/1,000 kcal	≥4.3 oz equivalent/1,000 kcal
Sodium	10	≤1.1 g/1,000 kcal	≥2.0 g/1,000 kcal
Empty calories[n]	20	≤19% of energy	≥50% of energy
Total score	100		

[a]Concentrations between the minimum and maximum standard are scored proportionately. Higher scores reflect higher nutritional quality.
[b]Higher scores reflect higher concentrations in meals.
[c]Includes 100% fruit juice.
[d]Includes all forms except juice.
[e]Includes any beans and peas not counted as total protein foods.
[f]Includes all milk products, such as fluid milk, yogurt, cheese, and fortified soy beverages.
[g]Beans and peas are included here (and not with vegetables) when the total protein foods standard is otherwise not met.
[h]Includes seafood, nuts, seeds, soy products (other than beverages) as well as beans and peas counted toward total protein foods.
[i]Ratio of PUFAs and MUFAs to SFAs.
[j]PUFA=Polyunsaturated fatty acid.
[k]MUFA=Monounsaturated fatty acid.
[l]SFA=Saturated fat.
[m]Higher scores reflect lower concentrations in meals.
[n]Energy from solid fats and added sugars. School meals do not include alcohol.

The score for refined grains increased from 46% to a near-perfect score of 96%. The score for sodium increased from 10% of the maximum to 27%. Scores also increased significantly for total fruit, whole fruit, total vegetables, total protein foods, fatty acids, and empty calories. The differences in scores for seafood and plant proteins and dairy were not statistically significant.

School Breakfasts

The mean total HEI-2010 score for school breakfasts served during SY 2014-2015 was 71% of the maximum possible score (Table 2). School breakfasts received near-perfect scores (of 95% or higher) for three of the adequacy components—total fruit, whole grains, and dairy. The score for whole fruit was slightly lower (89%), whereas scores for the remaining adequacy components (ie, fatty acids, total protein foods, seafood and plant proteins, total vegetables, and greens and beans) were <50% of the maximum possible scores. For the moderation components, school breakfasts received a near-perfect score for refined grains (95%) and a score of 93% of the maximum for sodium. The score for empty calories was slightly lower (83%).

As with school lunches, the total HEI-2010 score for school breakfasts increased significantly after the updated standards were in place (Figure 2). The total score increased from 50% of the maximum possible score during SY 2009-10 to 71% in SY 2014-2015. Scores for seven of the 12 HEI-2010 components increased significantly. Among the adequacy components, the largest increases were for whole grains and whole fruit. The score for whole grains increased from 38% of the possible maximum score to 96%, and the score for whole fruit increased from 50% to 89%. Increases in scores for total fruit and fatty acids were smaller but still statistically significant. The scores for all three moderation components increased significantly (indicating decreases in concentrations over time)—from 45% to a near-perfect score of 95% for refined grains, from 72% to 93% for sodium, and from 54% to 83% for empty calories.

DISCUSSION

These national results show that the lunches and breakfasts served in schools across the United States were more nutritious after the updated nutrition standards were in place and were largely consistent with DGA recommendations.[6,7] In

Table 2. Mean Healthy Eating Index 2010 scores, as percentage of maximum possible scores, for school lunches and breakfasts served during school year 2014-2015[a]

Component	School Lunches (n=1,206 schools)	School Breakfasts (n=1,110 schools)
	mean % of maximum score±standard error	
Total fruit	94.8±0.48	99.9±0.04
Whole fruit	98.0±0.35	89.4±1.00
Total vegetables	82.0±0.95	3.3±0.42
Greens and beans	71.6±1.36	0.1±0.03[b]
Whole grains	95.3±0.72	95.6±0.64
Dairy	99.4±0.17	99.0±0.17
Total protein foods	90.4±0.55	32.0±0.99
Seafood and plant proteins	46.1±1.37	13.4±0.85
Fatty acids	63.4±1.04	45.3±1.37
Refined grains	95.8±0.54	95.1±0.60
Sodium	27.0±0.93	92.8±0.74
Empty calories	96.1±0.29	82.8±0.57
Total score	81.5±0.25	71.3±0.26

[a]Data are from the School Nutrition and Meal Cost Study.
[b]Because the coefficient of variation is large, point estimate is considered less precise than other estimates.

addition, these findings suggest that school lunches and breakfasts served during SY 2014-2015 were of higher nutritional quality than children's overall diets. Based on the most recently reported national data, children's 24-hour intakes during 2011 and 2012 had an estimated total HEI-2010 score of 55% of the maximum[35] compared with 82% and 71%, respectively, for school lunches and breakfasts served during SY 2014-2015.

School lunches served during SY 2014-2015 received perfect or near-perfect scores (95% or higher) for total fruit, whole fruit, whole grains, dairy, refined grains, and empty calories. School breakfasts served during SY 2014-2015 received near-perfect scores for total fruit, whole grains, dairy, and refined grains, and came very close to a near-perfect score for sodium (93%). Moreover, scores for eight of the 12 HEI components for lunches and seven of the 12 components for breakfasts were 80% or more of the maximum possible scores, which indicates that the concentrations of these components in school meals were very consistent with the associated DGA recommendations. The lower total score for school breakfasts, relative to lunches, was driven partially by lower scores for a number of components that are not commonly consumed at breakfast. That is, foods contributing to total vegetables, greens and beans, and the seafood portion of the seafood and plant proteins component are not typically offered in school breakfasts or consumed at breakfast in the United States.[21,23,36]

These results provide strong evidence that the updated nutrition standards achieved their intended goals of making school meals more consistent with the DGA and improving their nutritional quality. For both lunches and breakfasts, there were significant increases in total HEI scores—of more than 20 percentage points—after the updated standards were in place, which indicates notable improvements in the nutritional quality of the meals. These increases in total scores were driven by substantial improvements (increases of more than 20 percentage points) in the scores for whole grains, refined grains, and empty calories for both meals, as well as for greens and beans for lunches and whole fruit and sodium for breakfasts.

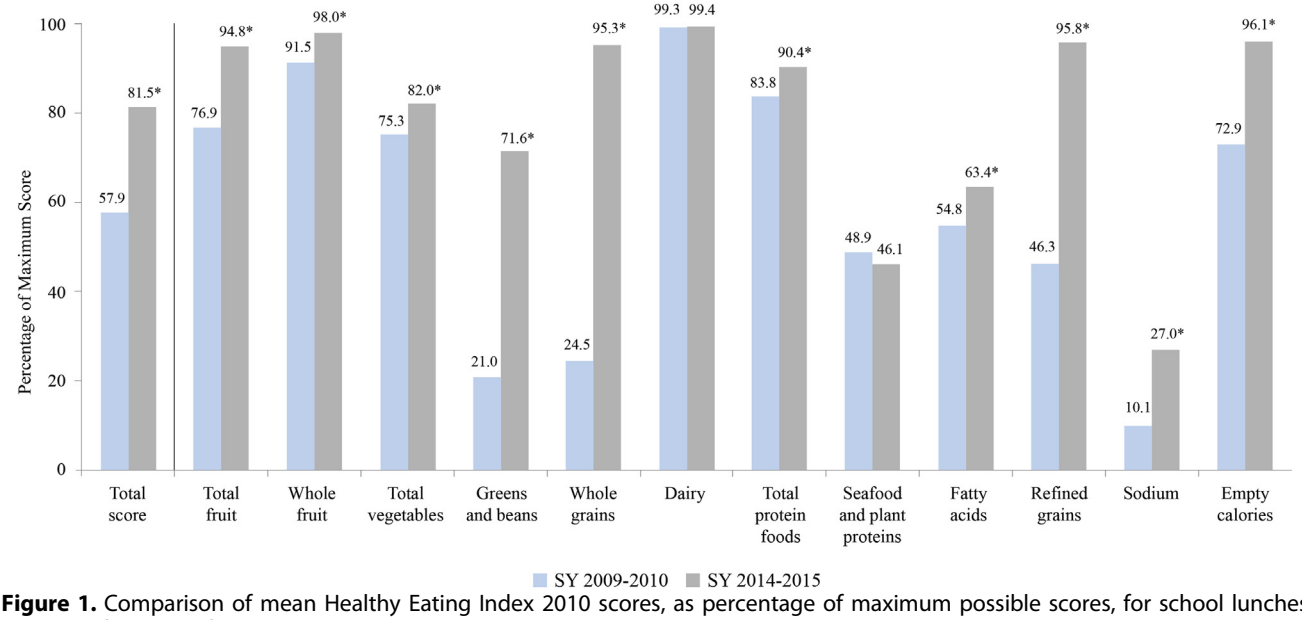

Figure 1. Comparison of mean Healthy Eating Index 2010 scores, as percentage of maximum possible scores, for school lunches served before and after the updated nutrition standards (school year [SY] 2009-2010 vs 2014-2015). *$P<0.05$.

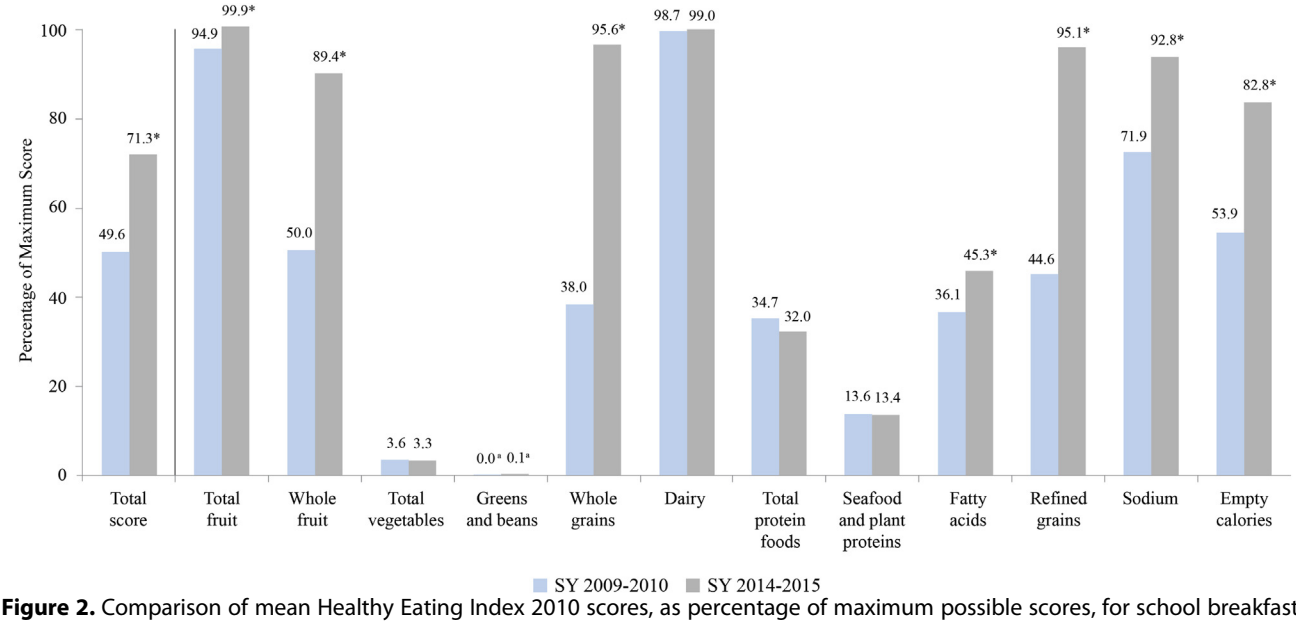

Figure 2. Comparison of mean Healthy Eating Index 2010 scores, as percentage of maximum possible scores, for school breakfasts served before and after the updated nutrition standards (school year [SY] 2009-2010 vs 2014-2015). [a]Because the coefficient of variation is large, point estimate is considered less precise than other estimates. *$P<0.05$.

The large increases in scores for whole grains and refined grains for both school lunches and breakfasts can be attributed to the new whole-grain requirement. During SY 2014-2015, all grains included in school meals had to be whole-grain rich (defined as foods that contain at least 50% whole grains). Although few schools were actually meeting this requirement,[21] these results show that the concentrations of whole grains and refined grains in school lunches and breakfasts were highly consistent with the recommendations of the DGA for these components.

A number of the changes set forth in the updated standards related to fruits and vegetables likely contributed to the increased scores for total fruit and whole fruit, as well as total vegetables and greens and beans for lunches. The updated standards require that schools offer students the ability to select fruits and vegetables as separate components in lunches, and students must select at least one-half cup from either the fruit or vegetable component in their meal. Under the prior standards, there was a combined requirement for fruits and vegetables (considered a single component), and students were not required to select a fruit or vegetable as part of their meal.[37] In addition, the updated standards included a new requirement that lunches must provide minimum amounts of five vegetable subgroups across the week, including dark green vegetables and legumes—both of which are specifically assessed in the HEI-2010 because intakes of these two vegetable subgroups differ the most from levels recommended in the DGA.[28] After the updated standards were in place, the score for the greens and beans component in lunches more than tripled. Last, scores for whole fruit were likely influenced by the limit on fruit juice introduced in the updated standards, particularly for school breakfasts where the score for this component increased by almost 40 percentage points.

The sizable increases in scores for the empty calories component (which assesses energy from solid fats and added sugars) for school lunches and breakfasts can also be attributed to a number of the updated requirements, including the restrictions on the types of milk allowed (restricted to fat-free or unflavored low-fat milk during SY 2014-2015), the amount of synthetic *trans* fat allowed in foods, and for lunches, the amount of grain-based desserts allowed. Similarly, the new limit on the sodium content of meals led to increased scores for the sodium component for both lunches and breakfasts (increases of 17 and 21 percentage points, respectively), indicating a large decrease in the concentration of sodium in meals. This finding is consistent with several small, local studies that found reductions in sodium content after implementation of the updated standards.[9,14,15,18] The standards established sodium targets to be phased in over several years, with the first target being in effect when data were collected during SY 2014-2015. The extended timeline was designed to give school food manufacturers time to reformulate products and give schools time to build students' acceptance of lower-sodium meals.[6]

Although the updated standards were implemented gradually over several years leading up to SY 2014-2015, they reflected major changes to menu planning and food purchasing and preparation for many school districts and schools. School foodservice staff have reported various challenges throughout the implementation process. Finding products that comply with the requirements, specifically for sodium and whole grains, has been reported as a major challenge.[20,38-40] In light of these challenges, during 2018 USDA established flexibilities for schools in meeting some requirements in the updated standards, acknowledging the challenges that some school districts and schools face in continuing to implement the standards. The flexibilities included allowing flavored low-fat milk, requiring at least half of grains (instead of all) to be whole-grain rich, and retaining the first sodium target until SY 2023-2024.[41] There was much debate leading up to this decision, particularly for whole grains and sodium. USDA received more than 85,000 public comments on the long-term availability of these

flexibilities (most were copies of form letters but there were 1,738 unique comments specific to the flexibilities).[41] Those opposed to the flexibilities worried that schools' future progress in increasing whole grains and reducing sodium in meals would be impeded and expressed concern about children's continued access to healthy meals.[41] Those in favor of the flexibilities argued that schools would have more control over the meals and could offer students more appealing meals, which would lead to increased meal consumption.[41] Ultimately, USDA decided that school nutrition operators needed these targeted flexibilities for efficient program operations.

Despite the dramatic improvement in the nutritional quality of school meals after the updated standards were introduced, additional changes to food offerings on lunch and breakfast menus could further improve scores on the HEI and consistency with the DGA. For example, the scores for seafood and plant proteins and fatty acids could be increased by encouraging schools to offer foods that are rich sources of unsaturated fats and a variety of proteins, including plant proteins such as nuts and seeds, seafood, beans and peas, and soy products, in place of some meat and poultry.[42] Despite significant reductions in the sodium content of meals, encouraging schools to continue efforts of offering foods at lunch that are lower in sodium is also a key step in further improving the quality of meals, particularly for school lunches where the concentration of sodium far exceeded the limit recommended in the DGA. Almost half the sodium in lunches during SY 2014-2015 came from entrée items, and in particular, sandwiches, Mexican items (such as burritos and tacos), and pizza were the leading contributors of sodium among the entrées.[21] These are key foods to target for sodium reduction.

A notable strength of the studies used in these analyses is their nationally representative sample designs, which allow the results to be generalized to the full population of public schools that provide meals through the NSLP and SBP. However, the studies excluded Alaska and Hawaii, even though these states provide meals through these programs. The timing of the collections of the menu survey data is also a strength, because the data unambiguously reflect school meals before and after the updated standards went into effect. Although, both studies collected data only in the second half of the school year, which may not account for the influence of seasonality on the different types of foods (particularly fruits and vegetables) offered in meals throughout the year. Another limitation of the design is the absence of a control group of schools. It was not feasible to include a control group of schools because implementation of the updated nutrition standards was a nationwide policy change for schools that participate in the NSLP and SBP. The updated nutrition standards were one of many reforms mandated by HHFKA, so it is possible that other changes happening in the school food environment also influenced the nutritional quality of the meals. Last, the HEI is the ideal measure for examining nutritional quality in relation to federal dietary guidance, although few studies have used it to assess school meals and changes over time.[9] However, the HEI does have a limitation related to assessing school breakfasts, because several components assessed in the HEI are not necessarily relevant to breakfasts.

CONCLUSIONS

The updated nutrition standards for school meals have significantly improved the nutritional quality of the meals and their consistency with the DGA. These results provide strong evidence that nutrition standards are important in ensuring that children have access to healthy meals during the school day. In the future, it will be important to monitor the nutritional quality of school meals, especially after schools have time to overcome implementation challenges with the standards, implement new flexibilities with the standards, and continue to receive technical assistance and training from USDA. The second iteration of the SNMCS will assess the nutritional quality of meals served during SY 2019-2020 so that trends in HEI scores can continue to be examined.

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E. C. Gearan conducted the analyses with technical guidance from M. K. Fox. E. C. Gearan wrote the first draft of the manuscript with contributions from M. K. Fox. Both authors reviewed and commented on subsequent drafts of the manuscript.

STATEMENT OF POTENTIAL CONFLICT OF INTEREST

No potential conflict of interest was reported by the authors.

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