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## Solid Fat and Added Sugar Intake Among U.S. Children:

### The Role of Stores, Schools, and Fast Food from 1994 to 2010

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#### Abstract

**Background**—Little is known about the role of location in U.S. children's excess intake of energy from solid fat and added sugar, collectively referred to as SoFAS.

**Purpose**—The goal of the study was to compare the SoFAS content of foods consumed by children from stores, schools, and fast-food restaurants and to determine whether trends from 1994–2010 differ across these locations.

**Methods**—Children aged 2–18 years ( $n=22,103$ ) from five nationally representative surveys of dietary intake from 1994 to 2010 were studied. SoFAS content was compared across locations for total intake and key foods. Regression models were used to test and compare linear trends across locations. Data were analyzed in 2012.

**Results**—The mean percentage of total energy intake consumed from each location that was provided by SoFAS remained above recommendations, despite significant improvements between 1994 and 2010 at stores (38.3% to 33.2%); schools (38.7% to 31.2%); and fast-food restaurants (43.3% to 34.6%). For each key food, SoFAS content decreased significantly at stores and schools, yet progress at schools was comparatively slower. Milk was higher in SoFAS at schools compared to stores due to shifts toward flavored milk at schools. Schools provided french fries that were higher in solid fat than store-bought versions and pizza that was not substantially different in SoFAS content than fast-food pizza. However, schools made substantially greater progress for sugar-sweetened beverages, as lower-sugar beverages replaced regular sodas. Key fast foods showed little improvement.

**Conclusions**—These findings can inform future strategies targeted to reduce SoFAS consumption in specific locations.

#### Introduction

In 2009–2010, 31.8% of U.S. children aged 2–19 years were overweight or obese.<sup>1</sup> To address the dietary factors contributing to this epidemic, the 2010 Dietary Guidelines for Americans advise children and adults to limit their intake of calories from solid fat and added sugar, collectively referred to as SoFAS.<sup>2</sup> Excessive SoFAS intake not only displaces more nutrient-dense foods, but also drives energy intake above caloric needs.<sup>2–5</sup> In 2003–

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2004, mean SoFAS intake among U.S. children was estimated at 39% of total energy (433 calories from solid fat and 365 calories from added sugar), an amount that exceeded the maximum recommendations for discretionary calorie intake for 97% of children.<sup>6–8</sup> Despite a decline to 33% in 2009–2010, average SoFAS intake remains above the recommended levels, which range from 8%–19% depending on total caloric needs.<sup>2,9</sup>

However, few studies have examined *where* children are obtaining these high levels of SoFAS. Saturated fat is a major component of solid fat, and comparison of foods consumed by children from different locations in 1994–1996 revealed higher saturated fat content of foods from schools (14.4% of total calories) and fast-food restaurants (13.6%) compared to store-bought foods (11.5%).<sup>10</sup> In 2005–2008, for all Americans, saturated fat content was highest for fast foods (13.5%); intermediate for school foods (12.3%); and lowest for store-bought foods (10.7%).<sup>11</sup> More recent comparisons of foods consumed by children and analysis of solid fat and added sugar content by location are not available. Top food sources of SoFAS include milk; sugar-sweetened beverages (SSBs); pizza; and french fries.<sup>8</sup> Several studies have identified these foods and beverages as items commonly consumed by U.S. children from stores, schools, and fast-food restaurants.<sup>12–16</sup> However, no studies have determined whether the SoFAS content of these key foods varies by the location where the food is obtained.

Moreover, no studies have directly compared the *changes* in SoFAS content of foods from these locations from 1994 to 2010, despite both voluntary and regulatory efforts to improve the nutritional content of children's diets that specifically targeted stores, schools, and fast-food restaurants during this time span.<sup>16–23</sup> From 1987–1988 to 1995, saturated fat density of foods consumed by all Americans declined for store-bought foods (13.5% to 10.9%) and fast foods (15.4% to 13.8%) but not for school foods (13.9% to 14.2%).<sup>24</sup> More recent analysis and trends specifically for children's intake of saturated fat are not available.

To address these research gaps, the purpose of this study is to compare the SoFAS content of foods consumed by children from stores, schools, and fast-food restaurants and to determine whether temporal trends from 1994–2010 differ across these locations. Changes in SoFAS consumption might result from modifications to the food supply by manufacturers, changes in the variety of available products with reduced added sugar or solid fat content, shifts in consumers' selection among these products, or changes in the frequency of consumption or portion size consumed for products with high SoFAS content. Updated trends on SoFAS consumption potentially reflect the effectiveness of location-specific strategies to improve dietary quality during the last 15 years and can identify areas that future public health efforts could target.

## Methods

### Participants

This analysis includes 22,103 children aged 2–18 years from five cross-sectional surveys of dietary intake from 1994 to 2010: the 1994–1996 Continuing Survey of Food Intakes by Individuals (CSFII), combined with the 1998 Supplemental Children's Survey (N=8797); and the National Health and Nutrition Examination Survey (NHANES) for 2003–2004 (N=3535), 2005–2006 (N=3741), 2007–2008 (N=2953), and 2009–2010 (N=3077). All surveys provide nationally representative estimates of dietary intake for the civilian, non-institutionalized U.S. population through use of a complex, multistage, stratified sampling design. Survey methodology is described in detail elsewhere.<sup>25–29</sup>

## Dietary Data

Two interviewer-administered 24-hour dietary recalls were collected by each survey using multiple-pass methodology. The first day was collected in person and the second day was collected 3–10 days later in person (CSFII) or by telephone (NHANES). For children aged <6 years, recalls were completed by a proxy respondent. For children aged 6–11 years, recalls were proxy-assisted.

Each food was recorded using a discrete food code with nutrient composition provided by food composition databases that reflect foods available at the time of each survey; all are based on the U.S. Department of Agriculture (USDA) National Nutrient Database for Standard Reference.<sup>30,31</sup> The USDA's MyPyramid Equivalents Database (MPED) was used to determine solid fat and added sugar content.<sup>32,33</sup> A complete description of this approach is provided in Appendix A (available online at [www.ajpmonline.org](http://www.ajpmonline.org)), and similar methodology has been utilized in previous studies and by the National Cancer Institute.<sup>34,35</sup>

Briefly, direct links were possible for CSFII 1994–1998 (MPED, version 1.0) and NHANES 2003–2004 (MPED version 2.0). Because updated MPED databases specific for NHANES 2005–2010 have not been released, MPED version 2.0 was used for food codes retained by subsequent surveys. SoFAS content of food codes newly introduced in 2005–2008 was provided by the Center for Nutrition Policy and Promotion's MPED 2.0 Addendum.<sup>36</sup> Food codes that were newly introduced in 2009–2010 were matched to similar food codes from prior surveys.

## Food Grouping

Previous work identified milk, SSBs (including regular and low-calorie/diet soft drinks, fruit drinks, sports drinks, and energy drinks); pizza; and french fries as top food group sources of total energy, added sugar, or solid fat from each location in 2009–2010 (J Poti, M Slining, B Popkin; University of North Carolina at Chapel Hill [UNC-CH], unpublished observations, 2013). Each food is represented by several food codes; for example, 59 milk food codes distinguish among plain and flavored versions and varying fat content.

## Location

The participant reported the location where each food or beverage was obtained. Locations were grouped into five categories: stores, including supermarkets, grocery stores, and convenience stores; schools, including school cafeterias, and child care centers; fast food, defined by the surveys as any restaurant without a wait staff and including pizza home delivery; restaurants with wait staff; and other, including vending machines, food/ice cream trucks, foods from other people, and sports/recreation facilities.<sup>37</sup> Based on the percentage of total calorie intake from each location, this analysis focused on stores (66.7%); schools (7.9%); and fast food (12.7%) because restaurants (5.3%) represent a small proportion of children's calories, and other sources (7.4% collectively) are a heterogeneous category. Location food consumers were defined as children who reported any items obtained from a given location during the first day of dietary recall.

## Analytic Sample

This analysis includes children with one complete dietary recall deemed reliable by study developers. Only the first day was used because the MPED 2.0 Addendum only includes new food codes reported on recall Day 1, and differences in how recalls were conducted for Day 2 (in person for CSFII and by telephone for NHANES) limit comparability. Children were excluded if missing the location for any food item ( $n=290$ ); if breastmilk was reported ( $n=7$ ); or if foods for which SoFAS content could not be estimated in 2009–2010 were consumed ( $n=29$ ).

## Data Analysis

Trends from 1994–2010 in the SoFAS content of total intake and key food groups were described and compared across locations. Using linear regression, linear trends were tested using Wald's  $F$ -test. Trends were compared across locations using interactions of location and time with  $p < 0.1$  considered significant. To compare locations for a given year,  $t$ -tests were used with  $p < 0.05/3$  considered significant, which includes Bonferroni correction for multiple (3) comparisons. SoFAS intake from each location was compared to the maximum recommendation of 19% of total energy using  $t$ -tests.<sup>2</sup> Survey commands within Stata (version 12) were used to account for complex survey design and to incorporate sample weights, which reflect probability of selection, nonresponse, and poststratification. Data analysis occurred in 2012 and was deemed exempt by the UNC-CH IRB.

## Results

Sociodemographic characteristics of participants for each survey are provided in Table 1 for all children and in Appendix B (available online at [www.ajpmonline.org](http://www.ajpmonline.org)) for consumers of foods from each location. The percentage of total energy intake consumed from each location that was provided by SoFAS decreased significantly between 1994–1998 and 2009–2010 for foods consumed by children from each location (Table 2). These improvements were significantly greater for schools (38.7% to 31.2%) and fast-food restaurants (43.3% to 34.6%) compared to stores (38.3% to 33.2%). Percentage added sugar significantly declined by a similar amount at each location but was significantly higher for store-bought foods compared to school and fast foods at all timepoints. Although significant decreases in percentage solid fat were greater for schools and fast food compared to stores, solid fat was greatest for fast-food restaurants and higher for schools compared to stores during each survey period. In 2009–2010, SoFAS consumption from each location exceeded the maximum recommended intake.

For milk at all locations, the percentage added sugar increased across time while percentage solid fat decreased (Figure 1). The magnitude of these changes was significantly greater for schools and fast food compared to stores. Consequently, percentage solid fat was significantly lower for school-bought milk compared to store-bought milk after 2007. Counteracting this improvement, school-bought milk had a significantly higher percentage added sugar than store-bought milk for all years, as 57% of milks obtained from schools were chocolate or flavored compared to 15% at stores in 2009–2010 (Appendix C, available online at [www.ajpmonline.org](http://www.ajpmonline.org)). Increases in the frequency of flavored milk consumption from 1994–1998 to 2009–2010 were also greater for schools compared to stores. Thus, milk consumed by children was significantly higher in total SoFAS when obtained from schools (39%) compared to stores (32%) in 2009–2010 and at all timepoints.

The percentage solid fat in pizza decreased significantly across time for all locations, and the magnitude of the decrease was significantly greater for stores compared to either schools or fast-food restaurants (Figure 1). Nevertheless, school-bought and store-bought pizza were not significantly different than fast-food pizza in terms of percentage SoFAS for most survey years. Beneficial decreases in percentage solid fat were observed for both store-bought and school-bought french fries, although the improvement was significantly greater for stores compared to schools (Figure 1). Consequently, at all timepoints, school-bought fries were higher in percentage solid fat than store-bought fries, although lower than fast-food fries. Fries from fast-food restaurants slightly increased in percentage solid fat during this time period.

The percentage added sugar from SSBs showed a significant decrease at all locations (Figure 1). The decline was significantly larger for SSBs from schools and smaller for fast

food, compared to store-bought SSBs. This decline in added sugar for SSBs from schools resulted from a major shift in the type of SSBs consumed (Appendix D, available online at [www.ajpmonline.org](http://www.ajpmonline.org)): 45% of SSBs consumed from school in 1994–1998 were regular soft drinks, compared to only 5% in 2009–2010. These sodas were replaced mainly by low-calorie fruit drinks, as well as regular fruit drinks and sports drinks.

## Discussion

To our knowledge, this is the first study to describe and compare trends from 1994–2010 in the SoFAS content of foods consumed by U.S. children from stores, schools, and fast-food restaurants. Total SoFAS, added sugar, and solid fat intakes declined significantly at each location during this time span. However, SoFAS consumption from each location in 2009–2010 greatly exceeded recommendations. Thus, examination of individual food groups is needed to identify specific key foods contributing to excessive SoFAS consumption, so that future public health efforts can target these foods. Although significant improvements were observed for each key food consumed by children from stores and schools, this study uniquely finds that progress at schools was comparatively slower for milk, pizza, and french fries.

### Stores

Significant improvements in SoFAS content of foods consumed by children from stores were observed overall and for each of these key foods. In 2009–2010, although overall added sugar content was significantly greatest for store-bought foods, solid fat content was lowest compared to the other locations. In agreement, previous studies found that saturated fat content was lowest for store-bought foods.<sup>11</sup> Decreases in solid fat of pizza and fries were greater for store-bought items compared to school or fast foods. Moreover, milk and fries from stores were lower in percentage SoFAS than either school-bought or fast-food items in 2009–2010. No prior work has examined changes over time in SoFAS content specifically for store-bought foods. Declines in SoFAS content of store-bought foods during this time span might result from voluntary pledges by food manufacturers to reduce the calorie content of packaged foods, and commitments by food retailers to reduce trans fat and added sugar content of products sold in their stores.<sup>16–18</sup>

### Schools

Schools made significant improvements from 1994–2010, as percentage SoFAS overall and for each key food decreased. Previous studies noted declines in whole milk availability and increased frequency of healthy food-preparation techniques at schools, which may explain decreases in the solid fat percentage in school foods.<sup>15,38</sup> This analysis notes the success of schools in decreasing added sugar content of SSBs by shifting intake away from regular sodas. In agreement, substantial reduction in sales of full-caloric colas among high school students and the transition toward lower-calorie beverages have been previously documented.<sup>22</sup> These improvements might reflect the success of policies implemented during this time span, including legislation requiring that federal meal programs align with dietary guidelines and mandating school wellness policies, as well as efforts by the Alliance for a Healthier Generation to remove nondiet soft drinks from schools and increases in states with nutrition standards.<sup>20–22,39</sup>

However, direct comparison of changes across locations revealed that schools achieved more limited progress than stores in reducing SoFAS content of milk, pizza, and fries. Milk consumed by children was higher in percentage added sugar and SoFAS when obtained from schools compared to stores throughout the 1994–2010 time span as a result of shifts toward flavored milk at schools (57% of milk in 2009–2010). In agreement, both the third

School Nutrition Dietary Assessment Study and the CDC's School Health Policies and Programs Study estimated that about 50% of school milk was chocolate or flavored.<sup>15,40</sup> Fries consumed by children from schools were substantially higher in solid fat content (37%) compared to store-bought fries (16%), and pizza consumed from schools was no different in solid fat content (25%) compared to fast-food pizza (26%). Consistent with these results, previous studies found that pizza was a top source of saturated fat in the National School Lunch Program, and french fries were a key low-nutrient, energy-dense food obtained from schools.<sup>14,41</sup>

Many recent studies of the school food environment also support the need for additional improvements at schools.<sup>14,15,42–46</sup> These changes may be achieved by the Healthy, Hunger-Free Kids Act of 2010, which updated USDA nutrition standards for school meals and established standards for competitive school foods.<sup>47</sup> This analysis supports the need for these updated standards, which can potentially decrease SoFAS intake by reducing saturated and trans fat content of meals and by limiting availability to fat-free or 1% milk.<sup>48,49</sup> However, the significantly higher added sugar content of school compared to store-bought milk suggests that standards could be revised to reduce availability of flavored milk, regardless of its fat content.

### Fast Food

Despite decreases in overall SoFAS and solid fat content for fast-food restaurants, total solid fat remained greatest for fast foods throughout this time span. The percentage SoFAS in milk did not improve and the percentage solid fat in french fries slightly increased from 1994 to 2010. Similarly, previous studies found that the percentage fat for fast foods consumed by Americans increased from 40.0% to 41.1% between 1977 and 2010, and median energy content of fast foods did not improve from 1997 to 2010.<sup>11,50</sup> SoFAS content was highest for milk, fries, and SSBs consumed by children from fast-food restaurants. In agreement, several recent studies found that few items on fast-food children's menus meet dietary guidelines for added sugar and saturated fat.<sup>13,51–53</sup>

### Strengths and Limitations

A main strength of this analysis is use of large, nationally representative samples spanning the past 15 years and including the most-recent data from 2009–2010. A main limitation of this analysis is that an updated MPED is not available for 2005–2010, so added sugar and solid fat were derived using MPED 2.0 and the MPED Addendum. However, previous studies employed similar methods, and sensitivity analyses confirmed the robustness of results to this approach (Appendix A, available online at [www.ajpmonline.org](http://www.ajpmonline.org)).<sup>34,35</sup> The current data cannot distinguish between product reformulations by manufacturers; changes in the availability of alternate versions of a given food with differing SoFAS content (e.g., plain or flavored milk); and shifts in consumers' choices either to avoid products high in SoFAS or consume them with decreased frequency or in smaller portion sizes. Thus, further studies are needed to identify which potential explanation is the main driver of reductions in SoFAS consumption.

Although the accuracy of these results might be limited by lack of location-specific nutrition information, between 15 and 116 different food codes were available for each food group. Under-reporting of foods perceived as unhealthy is a potential limitation and might vary across time, but no studies indicate that misreporting varies by location.<sup>54,55</sup> Because these surveys do not distinguish between supermarkets and smaller food stores, further studies are needed, as these locations vary greatly in healthful food availability.<sup>56,57</sup>

## Conclusion

This study provides a comprehensive comparison of changes from 1994 to 2010 in the SoFAS content of foods consumed by children from stores, schools, and fast-food restaurants. Decreases in overall SoFAS content from all locations and for key foods from stores and schools were encouraging. However, SoFAS intake continues to exceed recommendations, supporting the conclusion of several previous studies: efforts to reduce children's consumption of SoFAS must be made across multiple locations.<sup>41,53,58–60</sup>

The current findings can inform strategies targeted to the specific food sources and locations where continued progress is needed. In particular, added sugar in flavored milks and excessive solid fat in pizza and french fries should be targeted as schools implement new nutrition standards for school meals and policymakers finalize standards for competitive foods. Further monitoring is necessary to evaluate the impact of food manufacturers' and retailers' commitments to improve store-bought foods, implementation of school nutrition standards, and menu-board labeling at fast-food restaurants.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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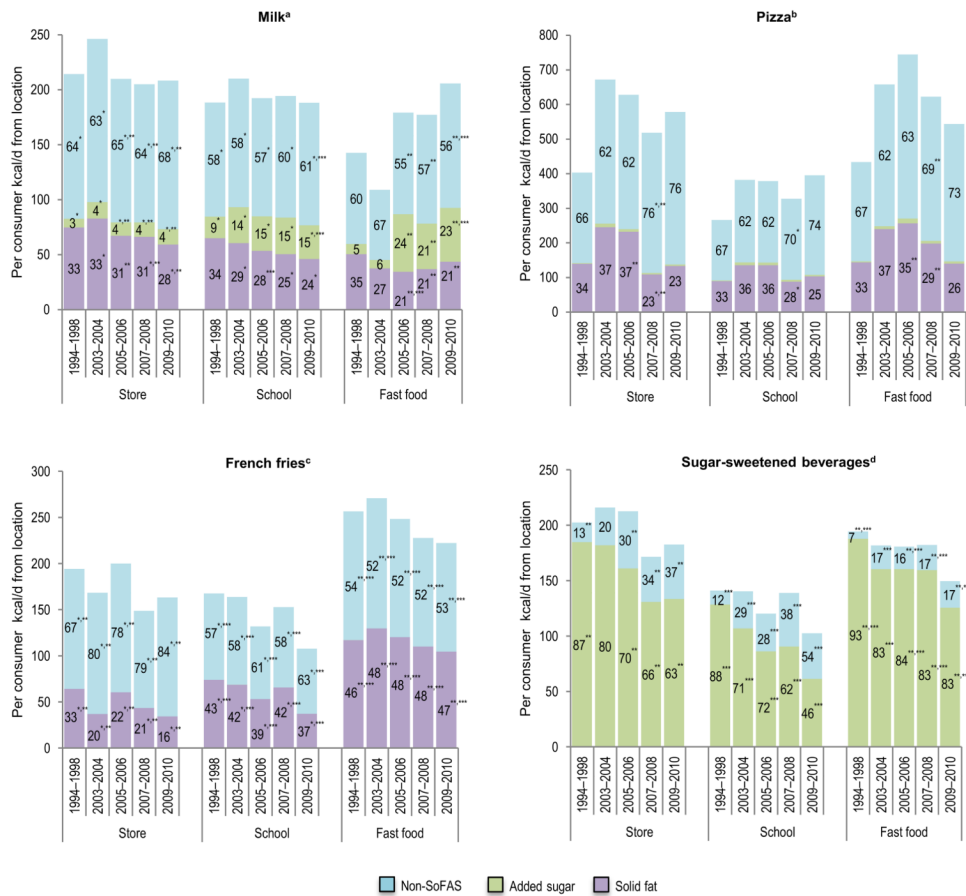
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**Figure 1.**

Added sugar and solid fat content of milk, pizza, french fries, and sugar-sweetened beverages consumed by children from stores, schools, and fast-food restaurants, 1994–2010  
*Note:* Data for children aged 2–18 years from CSFII 1994–1998 and NHANES 2003–2010. Numbers in bars are the percentage of food group kcal per day from non-SoFAS calories, added sugar, and solid fat at each location. Significance testing compares values in a given year for all pairwise comparisons of locations.

<sup>a</sup> Includes all types of milk such as whole, 2%, 1%, and nonfat milks (plain, chocolate, and flavored)

<sup>b</sup> Includes all types of pizza, calzones, and pizza rolls

<sup>c</sup> Includes french fries, home fries, and hash browns

<sup>d</sup> Includes regular, low-calorie, and diet sugar-sweetened beverages such as soft drinks, fruit drinks, sports drinks, and energy drinks

\* Store and school are significantly different

\*\* Store and fast food are significantly different

\*\*\* School and fast food are significantly different

kcal/d, kilocalories per day; SoFAS, total energy from solid fat and added sugar

CSFII, Continuing Survey of Food Intakes by Individuals; NHANES, National Health and Nutrition Examination Survey

**Table 1**

Sociodemographic characteristics of U.S. children aged 2–18 years, 1994–2010, %

	CSFII 1994–1998 N=8797	NHANES 2003–2004 N=3535	NHANES 2005–2006 N=3741	NHANES 2007–2008 N=2953	NHANES 2009–2010 N=3077
<b>Age group, years<sup>a</sup></b>					
2–5	24.7	22.5	22.7	23.6	23.4
6–11	35.4	34.9	34.4	34.4	34.9
12–18	39.9	42.6	42.9	42.0	41.7
<b>Female</b>	48.9	48.4	49.1	50.1	49.8
<b>Race/ethnicity</b>					
Non-Hispanic white	65.2	62.6	60.5	60.0	57.5
Non-Hispanic black	16.1	15.0	14.6	14.6	13.5
Mexican-American	6.6	12.6	13.5	13.2	14.4
Other	12.1	9.7	11.5	12.2	14.6
<b>Household income, % federal poverty level<sup>b</sup></b>					
130	26.4	33.9	27.3	33.1	33.7
131–299	34.7	31.1	32.6	28.5	28.5
300	38.9	35.0	40.1	38.3	37.8
<b>Household education<sup>c</sup></b>					
< High school	10.9	20.2	18.5	20.9	20.4
High school <sup>d</sup>	29.5	26.7	24.9	25.1	20.8
Some college	25.6	34.4	34.2	28.5	30.2
College degree	33.9	18.7	22.4	25.5	28.6

<sup>a</sup> All percentages take into account survey design and sample weights.

<sup>b</sup> Household income expressed as percentage of the Federal Poverty Level.

<sup>c</sup> Education level of household referent.

<sup>d</sup> Graduated from high school or obtained GED

CSFII, Continuing Survey of Food Intakes by Individuals; GED, General Educational Development test; NHANES, National Health and Nutrition Examination Survey

Table 2

SoFAS content of foods consumed by children from stores, schools, and fast food restaurants<sup>a</sup>

	CSFII		NHANES		NHANES		NHANES		<i>p</i> for trend	<i>P</i> for interaction
	1994–1998	2003–2004	2005–2006	2007–2008	2009–2010					
	N= 8797	N= 3535	N= 3741	N= 2953	N= 3077					
<b>SoFAS, % kcal/day<sup>b</sup></b>										
Total	38.9 ± 0.2	37.3 ± 0.6	36.4 ± 0.3	35.0 ± 0.3	33.4 ± 0.3	<0.0001	-			
Store	38.3 ± 0.3 <sup>Y</sup>	38.1 ± 0.7 <sup>X</sup>	36.1 ± 0.5 <sup>Y</sup>	35.5 ± 0.5 <sup>Y</sup>	33.2 ± 0.4 <sup>X</sup>	<0.001	ref			
School	38.7 ± 0.5 <sup>Y</sup>	33.9 ± 1.1 <sup>Y</sup>	35.8 ± 0.8 <sup>Y</sup>	32.2 ± 0.7 <sup>Z</sup>	31.2 ± 0.8 <sup>Y</sup>	<0.001	<0.001			
Fast food	43.3 ± 0.6 <sup>X</sup>	37.9 ± 0.7 <sup>X</sup>	39.1 ± 0.6 <sup>X</sup>	37.2 ± 0.6 <sup>X</sup>	34.6 ± 1.0 <sup>XY</sup>	<0.001	<0.001			
<b>Added sugar, % kcal/day</b>										
Total	17.7 ± 0.2	17.1 ± 0.5	15.8 ± 0.3	15.1 ± 0.3	14.1 ± 0.4	<0.0001	-			
Store	19.3 ± 0.3 <sup>X</sup>	20.0 ± 0.7 <sup>X</sup>	17.7 ± 0.5 <sup>X</sup>	17.2 ± 0.5 <sup>X</sup>	15.6 ± 0.5 <sup>X</sup>	<0.001	ref			
School	13.3 ± 0.6 <sup>Z</sup>	12.0 ± 1.0 <sup>Y</sup>	12.9 ± 0.8 <sup>Y</sup>	10.9 ± 0.5 <sup>Y</sup>	10.4 ± 0.6 <sup>Y</sup>	<0.001	0.5			
Fast food	15.8 ± 0.7 <sup>Y</sup>	11.7 ± 0.7 <sup>Y</sup>	12.3 ± 0.9 <sup>Y</sup>	12.1 ± 0.7 <sup>Y</sup>	10.7 ± 1.1 <sup>Y</sup>	<0.001	0.2			
<b>Solid fat, % kcal/day</b>										
Total	21.1 ± 0.2	20.1 ± 0.3	20.6 ± 0.2	19.8 ± 0.3	19.3 ± 0.2	<0.0001	-			
Store	18.9 ± 0.2 <sup>Z</sup>	18.1 ± 0.4 <sup>Z</sup>	18.4 ± 0.2 <sup>Z</sup>	18.3 ± 0.3 <sup>Z</sup>	17.6 ± 0.3 <sup>Z</sup>	<0.001	ref			
School	25.4 ± 0.3 <sup>Y</sup>	22.0 ± 0.7 <sup>Y</sup>	22.9 ± 0.5 <sup>Y</sup>	21.3 ± 0.5 <sup>Y</sup>	20.9 ± 0.6 <sup>Y</sup>	<0.001	<0.0001			
Fast food	27.5 ± 0.4 <sup>X</sup>	26.2 ± 0.5 <sup>X</sup>	26.7 ± 0.8 <sup>X</sup>	25.1 ± 0.7 <sup>X</sup>	23.9 ± 0.7 <sup>X</sup>	<0.001	0.01			
<b>Total energy, per capita (kcal/day)<sup>c</sup></b>										
Total	2005 ± 24	2118 ± 23	2026 ± 34	1907 ± 25	1907 ± 25	0.003	-			
Store	1365 ± 25 <sup>X</sup>	1407 ± 34 <sup>X</sup>	1326 ± 25 <sup>X</sup>	1242 ± 21 <sup>X</sup>	1310 ± 20 <sup>X</sup>	0.005	ref			
School	175 ± 7 <sup>Z</sup>	150 ± 20 <sup>Z</sup>	133 ± 12 <sup>Z</sup>	162 ± 19 <sup>Z</sup>	162 ± 19 <sup>Y</sup>	0.2	0.07			
Fast food	216 ± 8 <sup>Y</sup>	316 ± 21 <sup>Y</sup>	287 ± 18 <sup>Y</sup>	240 ± 16 <sup>Y</sup>	207 ± 9 <sup>Y</sup>	0.4	0.007			
<b>Total energy, per consumer (kcal/day)<sup>d</sup></b>										
Store	1395 ± 24 <sup>X</sup>	1426 ± 33 <sup>X</sup>	1341 ± 26 <sup>X</sup>	1260 ± 21 <sup>X</sup>	1324 ± 20 <sup>X</sup>	0.001	ref			
School	654 ± 13 <sup>Z</sup>	675 ± 31 <sup>Z</sup>	628 ± 21 <sup>Z</sup>	650 ± 31 <sup>Y</sup>	670 ± 23 <sup>Y</sup>	0.9	0.007			

	CSFII 1994–1998 N= 8797	NHANES 2003–2004 N= 3535	NHANES 2005–2006 N= 3741	NHANES 2007–2008 N= 2953	NHANES 2009–2010 N= 3077	<i>p</i> for trend	<i>P</i> for interaction
Fast food	746 ± 17 <sup>Y</sup>	825 ± 25 <sup>Y</sup>	792 ± 24 <sup>Y</sup>	735 ± 32 <sup>Y</sup>	655 ± 13 <sup>Y</sup>	<b>0.02</b>	0.3

Note: Boldface indicates significance.

<sup>a</sup>Data for children aged 2–18 years. Values are M± SE and take into account survey design and sample weights. Mean percentages are calculated as means of per-person ratios. Linear trends were significant at *p*<0.05, and test of interactions with *p*<0.1 indicated that linear trends for schools or fast-food restaurants were significantly different from linear trends for stores.

<sup>b</sup>Percentage of energy intake per day (% kcal/day) from a given location that was provided by SoFAS among consumers at that location.

<sup>c</sup>Mean total energy intake per capita consumed from each location, including consumers and nonconsumers.

<sup>d</sup>Mean total energy intake consumed from each location among store food consumers, school food consumers, and fast-food consumers.

<sup>x, y, z</sup>Means for stores, schools, and fast-food restaurants were compared for the specified survey year using pairwise *t*-tests with *p*<0.05/3, which includes Bonferroni correction, considered significant. Within columns for each nutrient, values with a common letter are not significantly different.

CSFII, Continuing Survey of Food Intakes by Individuals; kcal/d, kilocalories per day; NHANES, National Health and Nutrition Examination Survey; SoFAS, total energy from solid fat and added sugar