

# Where Are Kids Getting Their Empty Calories? Stores, Schools, and Fast-Food Restaurants Each Played an Important Role in Empty Calorie Intake among US Children During 2009-2010

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## ARTICLE INFORMATION

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## ABSTRACT

Consumption of empty calories, the sum of energy from added sugar and solid fat, exceeds recommendations, but little is known about where US children obtain these empty calories. The objectives of this study were to compare children's empty calorie consumption from retail food stores, schools, and fast-food restaurants; to identify food groups that were top contributors of empty calories from each location; and to determine the location providing the majority of calories for these key food groups. This cross-sectional analysis used data from 3,077 US children aged 2 to 18 years participating in the 2009-2010 National Health and Nutrition Examination Survey. The empty calorie content of children's intake from stores (33%), schools (32%), and fast-food restaurants (35%) was not significantly different in 2009-2010. In absolute terms, stores provided the majority of empty calorie intake (436 kcal). The top contributors of added sugar and solid fat from each location were similar: sugar-sweetened beverages, grain desserts, and high-fat milk\* from stores; high-fat milk, grain desserts, and pizza from schools; and sugar-sweetened beverages, dairy desserts, french fries, and pizza from fast-food restaurants. Schools contributed about 20% of children's intake of high-fat milk and pizza. These findings support the need for continued efforts to reduce empty calorie intake among US children aimed not just at fast-food restaurants, but also at stores and schools. The importance of reformed school nutrition standards was suggested, as prior to implementation of these changes, schools resembled fast-food restaurants in their contributions to empty calorie intake.

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**T**HE 2010 DIETARY GUIDELINES FOR AMERICANS (DGA) recommend that both children and adults reduce their intake of calories from solid fat and added sugar, collectively referred to as empty calories.<sup>1,2</sup>

Because solid fat and added sugar contribute calories without providing essential nutrients, excessive consumption of these empty calories has been shown to displace more nutrient-dense foods and drive energy intake above calorie needs.<sup>1,3-5</sup> Solid fats (discretionary fats that are solid at room temperature) are largely composed of saturated and *trans*-fatty acids, which are associated with increased risk of cardiovascular disease.<sup>1,6,7</sup> Added sugars are defined as caloric sweeteners added to foods during processing, preparation, or at the table, but excluding natural sugars found in fruit and milk.<sup>1</sup> In addition to contributing to excessive calorie intake, high consumption of added sugar has been associated with increased body weight

and cardiovascular disease risk factors.<sup>8-10</sup> Therefore, the 2010 DGA specify that consumption of empty calories should be limited to 8% to 19% of total energy intake, depending on total calorie requirements.<sup>1</sup>

There is great need for policy efforts and environmental changes to help American children meet these 2010 DGA recommendations, because 97% of US children had intake of energy from solid fat and added sugar that exceeded the maximum discretionary calorie allowance in 2001-2004.<sup>11,12</sup> By 2009-2010, 33% of children's total energy intake came from empty calories (368 kcal from solid fat and 278 kcal from added sugar).<sup>13</sup>

Despite the substantial contribution of empty calories to total energy intake, little is known about where children obtain these empty calories. Retail food stores, including supermarkets, grocery stores, and convenience stores, provide the majority of overall energy intake for children (69%); we hereafter refer to all foods and beverages obtained from these locations as store-bought foods.<sup>14</sup> Schools provide up to 47% of daily energy intake for participants in the school meals programs.<sup>15</sup> Consumption of foods and beverages from

\*For this article, "high-fat milk" includes both whole milk and 2% milk, and "low-fat milk" includes both 1% and nonfat milk.

fast-food restaurants (hereafter referred to as fast foods) has increased steadily during recent decades.<sup>14,16</sup> In 1996, the saturated fat density of foods consumed by children was greatest for foods from schools (14.4% of total energy intake) and fast-food restaurants (13.6%) and lower for store-bought foods (11.5%).<sup>17</sup> More recent comparisons of children's intake across locations, as well as any comparison of added sugar and solid fat consumption, are not available. The need for these updated comparisons was identified by a recent review of the dietary effects of eating outside the home.<sup>18</sup> Previous studies identified sugar-sweetened beverages (SSBs), grain desserts, full-fat milk, and pizza as top contributors to empty calorie consumption for children, yet top contributors consumed specifically from stores, schools, and fast-food restaurants have not been identified.<sup>13,19</sup>

Thus, the purpose of our study was to compare the role of stores, schools, and fast-food restaurants in the intake of empty calories among US children during 2009-2010. This analysis focuses on three research questions: Does empty calorie consumption among US children differ for intake from stores, schools, and fast-food restaurants? What foods

are the top contributors to added sugar and solid fat intake from each location? For these specific foods, which location provides the majority of calories? Top foods contributing to empty calorie consumption at each location can be targeted by future policy efforts to improve the food environment.

## METHODS

### Participants

Our analysis studied data on children aged 2 to 18 years from the 2009-2010 National Health and Nutrition Examination Survey (NHANES), a cross-sectional survey that uses a complex, multistage, stratified sampling design to provide nationally representative estimates of dietary intake of the civilian, noninstitutionalized US population. Details about the survey methodology are available elsewhere.<sup>20</sup>

### Dietary Data

NHANES collected two interviewer-administered 24-hour dietary recalls using multiple-pass methodology. The first day was collected in person, and the second day was collected

Foods were recorded as consumed using discrete food codes. The nutrient composition (total energy, total fat, and total sugar) of each food was determined by the US Department of Agriculture (USDA) using the Food and Nutrient Database for Dietary Studies (FNDDS) (version 5.0, 2010). Because FNDDS does not include added sugar and solid fat content, these values were obtained from the USDA MyPyramid Equivalents Database (MPED) (version 2.0, 2008). MPED version 2.0 measures discretionary solid fats as fats that are solid at room temperature and in excess of the allowable amount found in the leanest/lowest-fat form of meat, poultry, fish, eggs, beans, and milk and in the basic/natural forms of grains, fruits, and vegetables. MPED version 2.0 defined added sugar as sugar used in processed and prepared foods, sugar eaten separately, or sugar added to foods at the table, but excluding naturally occurring sugars in milk (lactose) or fruit (fructose). This definition of added sugar does not include fruit juice concentrate used as an ingredient or sugar substitutes. Multi-ingredient foods are disaggregated into their basic ingredients, and the discretionary solid fat and added sugar content is calculated as the sum of solid fat or added sugar in each ingredient using a recipe retention factor method.

Food codes used by National Health and Nutrition Examination Survey (NHANES) 2003-2004 can be directly linked to MPED version 2.0. However, updated MPED databases specific for NHANES 2005-2010 had not been released at the time of this study. Thus, MPED version 2.0 and the Center for Nutrition Policy and Promotion's MPED 2.0 Addendum (2011) were used to estimate the empty calorie content of items reported during 2009-2010 using methodology employed both by previous studies and by the National Cancer Institute's Pyramid Servings Database for NHANES III.<sup>21,22</sup> Conversion factors of 9 kcal/g for solid fat and 16 kcal/tsp for added sugar were used, and empty calories were calculated as the sum of energy from solid fat and added sugar.<sup>1,13,19</sup>

Most food codes (89%) reported in NHANES 2009-2010 were also used for NHANES 2003-2004 so that empty calorie content was obtained directly from MPED. For these exact food code matches, the ratio of solid fat to total fat and the ratio of added sugar to total sugar in MPED were applied to the total fat and total sugar content from FNDDS for these same food codes in 2009-2010. Applying these ratios allows more accurate estimation of empty calories by incorporating FNDDS updates to total fat and total sugar information that reflect changes in the food supply between 2003-2004 and 2009-2010. Approximately 9% of food codes reported in 2009-2010 were newly introduced in NHANES 2005-2008; these have exact added sugar and solid fat content provided by the MPED 2.0 Addendum, which uses USDA methodology. The remaining 2% of food codes were newly introduced in NHANES 2009-2010. Of these 69 food codes, 44 were matched to items with similar food codes and food descriptions. For example, "CASHEW NUTS, DRY ROASTED, WITHOUT SALT" was reported in 2009-2010 and matched to "CASHEW NUTS, DRY ROASTED" in MPED. Matches could not be found for the remaining 25 food codes, so children consuming these foods (n=29) were excluded from our analysis.

To examine the effect of these estimations, two sensitivity analyses were performed: first, we included children (n=29) who consumed foods that were not estimable but excluded only those specific food items; and second, we directly used MPED values rather than applying ratios from MPED to FNDDS for total sugar and fat. Conclusions did not differ from the results presented here, confirming the robustness of our results to these estimations.

**Figure 1.** Methods used to calculate added sugar and solid fat content of foods in a study of empty calorie intake among US children during 2009-2010.

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