

Original Research

Trends in Energy Intake among US Children by Eating Location and Food Source, 1977-2006

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ABSTRACT

Background Little is known about the influence of location of food consumption and preparation upon daily energy intake of children.

Objective To examine trends in daily energy intake by children for foods eaten at home or away from home, by source of preparation, and for combined categories of eating location and food source.

Subjects The analysis uses data from 29,217 children aged 2 to 18 years from the 1977-1978 Nationwide Food Consumption Survey, 1989-1991 and 1994-1998 Continuing Survey of Food Intakes by Individuals, and 2003-2006 National Health and Nutrition Examination Surveys.

Methods Nationally representative weighted percentages and means of daily energy intake by eating location were analyzed for trends from 1977 to 2006. Comparisons by food source were examined from 1994 to 2006. Analyses were repeated for three age groups: 2 to 6 years, 7 to 12 years, and 13 to 18 years. Difference testing was conducted using a *t* test.

Results Increased energy intake (+179 kcal/day) by children from 1977-2006 was associated with a major increase in energy eaten away from home (+255 kcal/day). The percentage of daily energy eaten away from home increased from 23.4% to 33.9% from 1977-2006. No further increase was observed from 1994-2006, but the sources of energy shifted. The percentage of energy from fast food increased to surpass intake from schools and become the largest contributor to foods prepared away from home for all age groups. For foods eaten away from home, the percentage of daily energy from stores increased to become the largest source of energy eaten away from home. Fast food eaten at home and store-bought food eaten away from home increased significantly.

Conclusions Eating location and food source significantly influence daily energy intake for children. Foods prepared away from home, including fast food eaten at home

and store-prepared food eaten away from home, are fueling the increase in total energy intake. However, further research using alternative data sources is necessary to verify that store-bought foods eaten away from home are increasingly store-prepared.

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The increase in childhood obesity coincides with a shift in the American diet toward increased consumption of foods eaten and/or prepared outside the home (1-4). Concerns about the nutritional quality of these foods have placed a great deal of attention upon foods eaten away from home. The marked rise in the frequency and quantity of away-from-home food consumption, particularly at restaurants and fast-food establishments, has been well documented (4,5). For children in particular, the proportion of total energy obtained from all nonhome, nonschool food sources increased from 9% in 1977 to 22% in 1996, with the main source of away-from-home foods shifting from school to fast food (6).

Numerous studies have shown that foods obtained from away-from-home sources have lower nutritional content than foods prepared at home, although further research is needed (4-7). Both increased energy intake and lower diet quality have been associated with away-from-home foods (8,9). The lower nutritional content of fast food and its potential negative affect on diet quality have been documented (10-12). Similarly the quality of food purchased at schools has been questioned (5-7,13-16).

Yet most studies focus on foods prepared away from home but not foods consumed away from home (1-7). Research has largely ignored the combined influence on energy intake of the location of food consumption and the location of its preparation. Trends in energy intake by eating location have not been previously examined. With increasing consumption of take-out and home delivery combined with a decrease in time spent in food preparation and cooking, these are critical issues to understand (17,18). Furthermore, no research has examined foods obtained from particular sources, such as stores or fast food, by eating location.

This research systematically examined patterns and trends not only in away-from-home consumption but also in the combination of eating location and food source for US children. This analysis used nationally representative survey data for children aged 2 to 18 years to investigate

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the relationship among eating location, food source, and energy intake within the context of total daily intake. Trends in energy intake were determined for US children overall as well as for three age groups: preschoolers aged 2 to 6 years, young children aged 7 to 12 years, and adolescents aged 13 to 18 years. This study updated previous analyses of energy intake for foods prepared away from home and identified trends in energy intake by eating location. This analysis uniquely examined the proportion of store-bought and fast food eaten at home and away from home.

METHODS

This study used data on 29,217 children aged 2 to 18 years from four nationally representative surveys of food intake for the US population: 11,499 participants from the 1977 to 1978 Nationwide Food Consumption Survey (NFCS77) (19); 3,122 participants from the 1989 to 1991 Continuing Survey of Food Intakes by Individuals (CSFII89) (20); 7,952 participants from the 1994 to 1996 Continuing Survey of Food Intake by Individuals, combined with children ages 2 to 9 surveyed in 1998 (CSFII94) (21); and 6,644 participants from the 2003-2004 and 2005-2006 joint US Department of Agriculture (USDA) National Health and Nutrition Examination Surveys (NHANES03) (22). The surveys were self-weighting, multistage, stratified area probability samples of the US population. Details about each survey have been published previously.

The NFCS77 and CSFII89 surveys collected 3 consecutive days of dietary intake: one in-home, interviewer-administered 24-hour recall and two self-administered 1-day food intake records. The CSFII94 survey collected two nonconsecutive interviewer-administered 24-hour recalls by telephone. NHANES03 collected two nonconsecutive 24-hour recalls, with the first day of intake by trained dietary interviewers in the Mobile Examination Center and a second day by telephone interview 3 to 10 days later. These interviews used a fully automated, computer-assisted multiple-pass dietary recall method involving a five-step process to probe for potentially forgotten foods. For children aged 5 years of age and younger, a proxy respondent provided dietary information, and interviews for children aged 6 to 11 years were proxy-assisted.

For each survey, only the first 2 days of dietary intake were used to provide comparable data. Because the third day of dietary intake was collected only in NFCS77 and CSFII89, the third day was not used. The 2 days of dietary intake collected by CSFII94 and NHANES03 were similar in methods to earlier USDA surveys. To ensure comparability of dietary data and survey weights provided, only participants with both days of dietary intake were included.

Categorization of Location of Consumption and Source of Preparation

For all surveys, the percentage of energy intake by eating location for each age group of children was determined to examine trends across the past 30 years in eating at home vs eating away from home.

Energy intake by location of consumption is the only comparable measure available for all four sets of data. For each food consumed in NFCS77, the respondent was asked whether the food came from the home food supply and was eaten at home, came from the home food supply but was eaten outside the home, or was obtained and eaten away from home. The source of each food item was only ascertained for foods obtained and eaten away from home. Foods obtained outside the home but eaten at home do not clearly fit into any location category of NFCS77. Likewise, for each food item in the CSFII89 survey, the participant was asked whether the food was eaten at home, brought into the home but eaten away from home, or never brought into the home. For foods brought into the home, the respondent was asked to describe the food source as from fast food, Meals on Wheels, or another source; these categories do not separate store-bought, restaurant, school, or vending foods. A complete description of food source was only determined for foods never brought into the home. Therefore, NFCS77 and CSFII89 were only used in the analysis of eating location but not for food source.

Both the CSFII94 and NHANES03 surveys asked the respondent separate questions about the location of consumption and source for each food item. These surveys were used in this analysis of energy intake by source of food preparation. Source of preparation was classified as Home/Store, including purchases from grocery, convenience, and drug stores and supermarkets, that are prepared either at the store or in the home; Restaurant, including bars, taverns, lounges, and cafeterias; Fast Food, including pizza and carryout places; School, including school cafeterias and child care centers; Vending; and Other, including Meals on Wheels, soup kitchens, other community feeding programs, residential facilities, foods eaten at someone else's home, gifts, and other miscellaneous sources. Definitions of sources were uniform across CSFII94 and NHANES03. Also, categories were combined for eating location and source of preparation to more completely describe each food as eaten at home or eaten away and prepared at home or prepared away from home.

The source of purchase and the source of food preparation are generally the same. However, these surveys did not collect information about whether store-bought foods were prepared at home or fully prepared at the store. Store-bought foods include both whole foods prepared at home, such as raw meats that are cooked at home, and ready-to-eat foods prepared at the store, such as fried chicken cooked at a grocery store kitchen. The data for foods from stores do not allow further distinction between whole foods and ready-to-eat prepared foods. Therefore, the source of preparation for these foods is indicated as Home/Store. By necessity, store-bought foods are referred to as prepared at home, although we acknowledge that this approach fails to classify store-prepared foods as food prepared away from home. Food prepared away from home only includes foods from restaurant, fast food, school, vending, and other sources.

For all surveys, respondents were excluded from the study if the energy content of any food item or location of consumption for any energy-providing item was missing from the data set. Participants with only 1 day of dietary

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