Fast-Food and Full-Service Restaurant Consumption Among Children and Adolescents

Effect on Energy, Beverage, and Nutrient Intake

Lisa M. Powell, PhD; Binh T. Nguyen, MA

Objective: To examine the effect of fast-food and full-service restaurant consumption on total energy intake, dietary indicators, and beverage consumption.

Design: Individual-level fixed-effects estimation based on 2 nonconsecutive 24-hour dietary recalls.


Participants: Children aged 2 to 11 years (n=4717) and adolescents aged 12 to 19 years (n=4699).

Main Outcome Measures: Daily total energy intake in kilocalories; intake of grams of sugar, total fat, saturated fat, and protein and milligrams of sodium; and total grams of sugar-sweetened beverages, regular soda, and milk consumed.

Results: Fast-food and full-service restaurant consumption, respectively, was associated with a net increase in daily total energy intake of 126.29 kcal and 160.49 kcal for children and 309.53 kcal and 267.30 kcal for adolescents and with higher intake of regular soda (73.77 g and 88.28 g for children and 163.67 g and 107.25 g for adolescents) and sugar-sweetened beverages generally. Fast-food consumption increased intake of total fat (7.03-14.36 g), saturated fat (1.99-4.64 g), and sugar (5.71-16.24 g) for both age groups and sodium (396.28 mg) and protein (7.94 g) for adolescents. Full-service restaurant consumption was associated with increases in all nutrients examined. Additional key findings were (1) adverse effects on diet were larger for lower-income children and adolescents and (2) among adolescents, increased soda intake was twice as large when fast food was consumed away from home than at home.

Conclusion: Fast-food and full-service restaurant consumption is associated with higher net total energy intake and poorer diet quality.

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Children and adolescents are increasingly consuming food away from home (FAFH), particularly from fast-food sources. From 1977-1978 through 2003-2006, among children aged 2 to 18 years, the contribution to total caloric intake from fast-food and full-service restaurant sources increased from 2% to 13% and from 1% to 5%, respectively.1,2 In particular, for adolescents, the percentage of total energy from fast-food restaurants reached 17% in 2003-2006.3 From 1999 to 2004, frequent (≥3 times/wk) fast-food consumption among adolescents increased from 19% to 27% for females and from 24% to 30% for males.4

Upward trends in fast-food consumption have paralleled increasing obesity rates among children and adolescents, and consumption has been associated with greater total energy intake and poorer nutrient intake.5,6 Much of the existing literature is focused on the association of fast-food but not full-service restaurant consumption with energy intake and diet and use older data, nonnationally representative data, and/or cross-sectional methods. In addition, studies that used within-person comparisons did not control for other forms of FAFH intake or the day of the week on which it was consumed.

This study built on the previous literature by examining the relationship between fast-food and full-service restaurant consumption and energy intake, diet quality, and consumption of sugar-sweetened beverages (SSBs), particularly soda, controlling for consumption of other...
FAFH and the day of week. Analyses were undertaken for children and adolescents and by sex, ethnicity, and socioeconomic status. We provide herein new evidence examining differential effects according to whether the food was consumed AFH or at home. To control for individual-level unobserved characteristics, we estimated multivariate individual-level fixed-effects regression models using dietary recall data from the National Health and Nutrition Examination Survey (NHANES) 2003-2008.10

**METHODS**

**DATA**

We used dietary recall data from the participants in the NHANES 2003-2004, 2005-2006, and 2007-2008. The NHANES is an ongoing survey based on a complex, multistage sampling design to be nationally representative of the civilian, noninstitutionalized US population. Data collection procedures and survey design are described elsewhere.10 Our sample included children aged 2 to 11 years and adolescents aged 12 to 19 years who were not pregnant at the time of interview. We examined subpopulations by sex, race (non-Hispanic white, non-Hispanic black, and Hispanic), and income (low income, defined as families with income <130% of the federal poverty level; middle income, ≥130% and <300% of the federal poverty level; and high income, ≥300% of the federal poverty level).

The NHANES survey included 2 nonconsecutive 24-hour dietary recalls for which respondents reported on all food and beverages consumed in the preceding 24 hours. Day 1 interviews were conducted by trained dietary interviewers in a mobile examination center, and day 2 interviews were performed by telephone 3 to 10 days later. Participants aged 12 years or older completed their own dietary interviews, children aged 6 to 11 years completed proxy-assisted interviews, and proxy respondents reported for children younger than 6 years. This study included 4717 observations for children aged 2 to 11 years and 4609 observations for adolescents aged 12 to 19 years for whom there were complete dietary data for the 24-hour recalls from day 1 and day 2.

Survey respondents were asked about the source of each food and beverage item. Two key exposure indicators were constructed for whether, on a given day, any food or beverage items from the following sources were consumed: (1) a fast-food restaurant (fast food/pizza) and (2) a full-service restaurant (waiter/waitress, bar/tavern/lounge, or restaurant with no additional information). Respondents were also asked whether they consumed the item at home or AFH. Therefore, we additionally differentiated the source and location of intake for each food or beverage item based on whether it was from a fast-food or full-service restaurant eaten at home (ie, take-out, drive-through, or delivery) or AFH (ie, in a restaurant). Our analyses controlled for nonrestaurant FAFH, which included all food and beverage items consumed came from a fast-food or full-service restaurant, respectively, and NRFAFH, indicated whether there was any FAFH consumed from a nonrestaurant source. Finally, WD and D controlled for whether the recall day was a weekday vs a weekend and whether it was day 1 vs day 2, respectively, with vi as the standard individual-specific error and wi as the standard error term. We estimated equation 1 separately for children aged 2 to 11 years and adolescents aged 12 to 19 years and by sex, ethnicity, and socioeconomic status for both age groups.

We further examined whether restaurant consumption AFH vs at home had differential effects specified as follows:

1. For children, fast-food and full-service consumption, respectively, resulted in higher energy intake among children (160.49 kcal) and adolescents (309.53 kcal) for adolescents. Consuming from a full-service restaurant also was associated with higher energy intake among children (160.49 kcal) and adolescents (267.30 kcal). Fast-food and full-service restaurant consumption, respectively, resulted in higher intake of SSBs (91.41 g and 143.97 g for children and 162.40 g and 126.10 g for adolescents) in general and regular soda (73.77 g and 88.28 g for children and 163.67 g and 107.25 g for adolescents) in particular. Both fast-food and full-service restaurant consumption reduced milk intake by approximately 30 g for children and 50 g for adolescents.

2. For children, fast-food and full-service consumption were associated with higher intake of sugar (5.71 g and 15.43 g), total fat (7.03 g and 6.09 g), and saturated fat (1.99 g and 1.52 g). However, only full-service restaurant consumption was associated with increased sodium intake (225.71 mg) as well as higher protein intake (3.24 g). Fast-food and full-service restaurant consumption among adolescents significantly affected all the nutrients examined. For children, additional sugar intake was lower observed characteristics, such as age, sex, and race, and, given the short time between the day 1 and day 2 dietary recalls, it also removed the effects of household/parental characteristics, such as marital status, educational level, and income. More important, the individual-level fixed-effects model removed the time-invariant unobserved characteristics related to food and beverage preferences. The regression model for outcome Y was specified as follows:

(1) \( Y_i = \delta_0 + \delta_1 FF_i + \delta_2 FS_i + \delta_3 NRFAFH_i + \delta_4 WD_i + \delta_5 D_i + \epsilon_i + w_i \)

where \( FF_i \) and \( FS_i \) indicated whether any food or beverages consumed came from a fast-food or full-service restaurant, respectively, and \( NRFAFH_i \) indicated whether there was any FAFH consumed from a nonrestaurant source. Finally, \( WD_i \) and \( D_i \) controlled for whether the recall day was a weekday vs a weekend and whether it was day 1 vs day 2, respectively, with \( \epsilon_i \) as the constant individual-specific error and \( w_i \) as the standard error term. We estimated equation 1 separately for children aged 2 to 11 years and adolescents aged 12 to 19 years and by sex, ethnicity, and socioeconomic status for both age groups.

We further examined whether restaurant consumption AFH vs at home had differential effects specified as follows:

(2) \( Y_i = \delta_0 + \delta_1 FFAFH_i + \delta_2 FSAFH_i + \delta_3 FSAHi + \delta_4 FSAH_i + \delta_5 NRFAFH_i + \delta_6 WD_i + \delta_7 D_i + \epsilon_i + w_i \)

where, for fast-food (FFAFH, and FFAH), and full-service (FSAFH, and FSAHi) restaurants, the separate variable indicators distinguished whether items from these sources were consumed on the recall day AFH or at home. Estimation was undertaken using commercial software (Stata, version 11.1; StataCorp) and accounted for the NHANES complex, multistage probability sampling design. This study was approved by the institutional review board of the University of Illinois at Chicago.

Total kilocalories of energy intake; nutrient intake of food or full-service restaurant. We examined outcomes included 4717 observations for children aged 2 to 11 years and adolescents aged 12 to 19 years and by sex, ethnicity, and socioeconomic status for both age groups.

**RESULTS**

Summary statistics for all variables for day 1 and day 2 dietary recalls are reported in Table 1. Table 2 and Table 3 document the individual-level fixed-effects regression estimates for the within-person daily changes in energy, beverage, and nutrient intake. Fast-food restaurant consumption was associated with an increase in total daily energy intake of 126.29 kcal for children and 309.53 kcal for adolescents. Consuming from a full-service restaurant also was associated with higher energy intake among children (160.49 kcal) and adolescents (267.30 kcal). Fast-food and full-service restaurant consumption, respectively, resulted in higher intake of SSBs (91.41 g and 143.97 g for children and 162.40 g and 126.10 g for adolescents) in general and regular soda (73.77 g and 88.28 g for children and 163.67 g and 107.25 g for adolescents) in particular. Both fast-food and full-service restaurant consumption reduced milk intake by approximately 30 g for children and 50 g for adolescents.

For children, fast-food and full-service consumption were associated with higher intake of sugar (5.71 g and 15.43 g), total fat (7.03 g and 6.09 g), and saturated fat (1.99 g and 1.52 g). However, only full-service restaurant consumption was associated with increased sodium intake (225.71 mg) as well as higher protein intake (3.24 g). Fast-food and full-service restaurant consumption among adolescents significantly affected all the nutrients examined. For children, additional sugar intake was lower observed characteristics, such as age, sex, and race, and, given the short time between the day 1 and day 2 dietary recalls, it also removed the effects of household/parental characteristics, such as marital status, educational level, and income. More important, the individual-level fixed-effects model removed the time-invariant unobserved characteristics related to food and beverage preferences. The regression model for outcome Y was specified as follows:

(1) \( Y_i = \delta_0 + \delta_1 FF_i + \delta_2 FS_i + \delta_3 NRFAFH_i + \delta_4 WD_i + \delta_5 D_i + \epsilon_i + w_i \)

where \( FF_i \) and \( FS_i \) indicated whether any food or beverages consumed came from a fast-food or full-service restaurant, respectively, and \( NRFAFH_i \) indicated whether there was any FAFH consumed from a nonrestaurant source. Finally, \( WD_i \) and \( D_i \) controlled for whether the recall day was a weekday vs a weekend and whether it was day 1 vs day 2, respectively, with \( \epsilon_i \) as the constant individual-specific error and \( w_i \) as the standard error term. We estimated equation 1 separately for children aged 2 to 11 years and adolescents aged 12 to 19 years and by sex, ethnicity, and socioeconomic status for both age groups.

We further examined whether restaurant consumption AFH vs at home had differential effects specified as follows:

(2) \( Y_i = \delta_0 + \delta_1 FFAFH_i + \delta_2 FSAFH_i + \delta_3 FSAHi + \delta_4 FSAH_i + \delta_5 NRFAFH_i + \delta_6 WD_i + \delta_7 D_i + \epsilon_i + w_i \)

where, for fast-food (FFAFH, and FFAH), and full-service (FSAFH, and FSAHi) restaurants, the separate variable indicators distinguished whether items from these sources were consumed on the recall day AFH or at home. Estimation was undertaken using commercial software (Stata, version 11.1; StataCorp) and accounted for the NHANES complex, multistage probability sampling design. This study was approved by the institutional review board of the University of Illinois at Chicago.

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for fast-food compared with full-service restaurant consumption; however, the opposite was found for teens—fast-food and full-service restaurant consumption was associated with an additional 16.24 g and 7.28 g of sugar intake, respectively. Fast-food and full-service restaurant consumption similarly increased total fat intake (14.36 g and 14.49 g) and had similar effects on saturated fat intake (4.64 and 3.99 g) for adolescents. Fast-food consumption increased sodium intake by 396.28 mg and 624.90 mg, respectively. Protein intake was also higher for adolescents on days that they consumed from fast-food (7.94 g) or full-service (12.93 g) restaurants.

There were several differences between subpopulations; we focus the discussion through the rest of the “Results” section on fast-food consumption. Compared with females, male children and adolescents consumed more additional total calories on days that they consumed fast food (157.03 vs 89.88 kcal for children and 389.46 vs 231.49 kcal for adolescents). Fast-food consumption was associated with higher additional intake of SSBs, soda, protein, total fat, saturated fat, and sodium, but not sugar, for male compared with female adolescents. There were generally few differences by race in intake patterns associated with fast-food consumption among children, although it was associated with higher additional intake of soda and sodium among Hispanic children. Among adolescents, fast-food consumption was associated with substantially higher intake of soda for white compared with black and Hispanic adolescents (196.33 g vs 88.88 g and 95.30 g) and correspondingly higher additional intake of sugar. However, fast-food consumption was associated with higher additional total fat intake for black (20.43 g) compared with white (12.11 g) and Hispanic (15.39 g) adolescents. Fast-food consumption also increased sodium intake to a greater extent for black adolescents (591.80 mg) compared with white (366.40 mg) and Hispanic (319.40 mg) adolescents.

Numerous differential effects emerged by income. Among children, fast-food consumption resulted in fewer additional calories consumed in high-income (68.03 kcal) compared with low-income (159.02 kcal) and middle-income (175.34 kcal) families. Increased intake of SSBs and soda was also lower for children in high-income families, as was additional fat intake. Fast-food consumption had no significant effects on higher-income children’s intake of sugar, protein, and sodium. Among adolescents, those from lower-income families had larger increases in caloric intake when they consumed fast food (383.73 kcal) compared with adolescents from middle-income (289.52 kcal) and high-income (293.62 kcal) families. Fast-food consumption was associated with higher additional intakes of sugar, total fat, saturated fat, sodium for low-income adolescents compared with their high-income counterparts. At the same time, fast-food consumption was a greater source of increased protein for low-compared with middle- and high-income adolescents.

Table 4 reports on the differential effects of consuming from restaurant sources AFH compared with at home. Fast-food consumption at home increased children’s total caloric intake by 146.72 kcal, compared with 77.31 kcal from consumption AFH. For children, consuming fast

| Table 4. Summary Statistics for Day 1 and Day 2 Dietary Recall: Restaurant Consumption Prevalence and Energy, Beverage, and Nutrient Intake for Children and Adolescentsa |
|---------------------------------|------------------|------------------|------------------|------------------|
| | Age 2-11 y (n = 4717) | Age 12-19 y (n = 4699) |
| Prevalence of consumption, % | | | |
| Fast food | 36 | 42 | 35 |
| By location | | | |
| Away from home | 18 | 25 | 20 |
| At home | 20 | 21 | 18 |
| Full service | 15 | 18 | 12 |
| Nonrestaurant food away from home | 66 | 62 | 60 |
| Consumption on weekday | 58 | 55 | 80 |
| Energy and beverage intake, mean (SE) | | | |
| Energy, kcal | 1843.47 (15.50) | 1798.44 (13.58) | 2267.42 (18.89) | 2078.37 (19.92) |
| SSB, g | 349.31 (10.58) | 267.93 (9.08) | 699.23 (17.47) | 558.89 (15.33) |
| Regular soda, g | 163.51 (7.35) | 108.53 (5.64) | 422.72 (13.98) | 338.37 (13.98) |
| Milk, g | 325.40 (8.59) | 370.34 (9.40) | 237.78 (8.00) | 265.76 (11.40) |
| Nutrient intake, mean (SE) | | | |
| Sugar, g | 129.51 (1.42) | 121.09 (1.29) | 147.59 (1.55) | 132.41 (1.77) |
| Total protein, g | 62.50 (0.68) | 65.16 (0.54) | 80.66 (0.96) | 77.64 (0.78) |
| Total fat, g | 68.00 (0.80) | 66.14 (0.72) | 84.94 (0.89) | 77.15 (0.80) |
| Saturated fat, g | 24.36 (0.31) | 23.74 (0.30) | 29.31 (0.35) | 26.85 (0.30) |
| Sodium, mg | 2771.47 (30.82) | 2774.02 (34.32) | 3550.57 (43.27) | 3319.48 (34.07) |

Abbreviation: SSB, sugar-sweetened beverage.

All analyses were weighted using the National Health and Nutrition Examination Survey examination weight.
data on income were missing for some observations. Subgroup observation counts do not equal the total of 4717 because results were not reported for all race/ethnicity subgroups, such as Asian and other races, and indicators for consumption of nonrestaurant food away from home, whether the recall was on a weekday vs the weekend, and whether it was on day 1 vs day 2. Some consuming from a fast-food restaurant was associated with levels of within-person differences, the study results show that Based on multivariate individual-level fixed-effects models of within-person differences, the study results show that consuming from a fast-food restaurant was associated with a net increase in total daily energy intake of 126.29 kcal for children and 309.53 kcal for adolescents. Consumption from a full-service restaurant also was associated with higher energy intake among children (160.49 kcal) and adolescents (267.30 kcal). Thus, the evidence clearly suggests that nonrestaurant caloric intake is not sufficiently reduced to compensate for additional calories obtained on days when consuming from restaurants. Furthermore, restaurant consumption among children and adolescents was significantly related to higher nutrient intake of sugar, total fat, saturated fat, and sodium. In particular, for example, fast-food consumption among adolescents increased sugar, total fat, saturated fat, and sodium intake by approximately 13%, 22%, 25%, and 17% of the daily reference levels of these respective nutrients. Soda and SSB intake was significantly higher on days that children and adolescents consumed from restaurants, particularly for adolescents. However, positive associations were found for protein intake for full-service restaurant consumption among children and both fast-food and full-service consumption among adolescents.

Our results are generally consistent with previous studies that examined fast-food consumption. For example, evidence from the 1994-1996 and 1998 Continuing Sur-

food at home compared with AFH was associated with higher additional intakes of total fat (7.38 g), saturated fat (2.25 g), sugar (7.76 g), protein (2.37 g), and sodium (133.62 g), whereas fast-food consumption AFH was not significantly associated with these nutrient measures. Fast-food consumption was associated with greater SSBD and soda consumption to a slightly higher extent when consumed AFH. However, consumption AFH but not at home was significantly associated with less milk intake (41.5 g).

For adolescents, overall additional caloric intake was similar when fast food was consumed AFH vs at home. Both total and saturated fat and sodium intake was higher when fast food was consumed at home. However, additional SSBD and soda intake was twice as high when fast food was consumed AFH compared with at home: 226.02 g compared with 80.93 g for SSBD intake and 200.20 g compared with 98.73 g for soda intake.

**COMMENT**

Based on multivariate individual-level fixed-effects models of within-person differences, the study results show that consuming from a fast-food restaurant was associated with
A 1987 ten-year longitudinal study⁴ that monitored 9- and 10-year-old girls found a positive age gradient of fast-food consumption and that higher frequency of consumption was associated with higher energy intake and higher intake of sodium, total fat, and saturated fat. Cross-sectional analyses of frequency of fast-food use among a sample of students in grades 7 to 12 in Minnesota found associations with higher energy intake, fat, and soda intake and lower fruit, vegetable, and milk intake.⁵ Cross-sectional analyses based on more recent 2003-2004 NHANES data found that fast-food consumption was negatively associated with meeting MyPyramid recommended intake of fruits, vegetables, and milk and positively associated with discretionary energy and intake of total fat.⁶ Finally, our results are also consistent with a recent US Department of Agriculture study⁷ that used CSFII and NHANES data and first differencing regression analyses to examine how consumption of food prepared AFH (controlling for FAFH from schools) affects school-aged children’s diet quality. The study found that each FAFH meal was associated with lower diet quality and increased caloric intake by 108 kcal, and the effects similarly were larger for older children but overall smaller in magnitude than our study results that specified fast-food and full-service restaurant consumption as weekday vs the weekend, to account for differential preferences across the week and day 1 vs day 2 of the recall to account for potential bias based on recall conducted...
in person vs by telephone. However, because of data limitations, our analyses did not account for other time-varying confounders, such as physical activity or other unobserved factors that might affect food preferences from day to day. Nonetheless, all time-constant confounders were accounted for in the fixed-effects regression. Third, this study did not differentiate restaurant consumption by meal occasions. To better understand the impact of fast-food consumption by race/ethnicity and income levels, future research should investigate the extent to which different subpopulations have differential patterns of fast-food restaurant use across meals. In addition, future analyses should examine how fast-food consumption across different meal occasions may differentially affect caloric and nutrient intake.

Given the adverse effects of restaurant consumption and its high prevalence, particularly for fast food, policies aimed at reducing consumption and improving diet are increasingly being assessed and considered. Several studies found that lower fast-food prices are associated with higher consumption and weight outcomes, particularly for middle- and high-school youths, suggesting that policies that increase the relative prices of such meals may be effective instruments. In particular, low-income populations tend to be more price sensitive; analyses herein revealed greater adverse effects from fast-food consumption among lower-income populations, suggesting an important need for effective policies among this group.

Analyses that accounted for place of consumption had potentially important policy implications. Adolescents consumed twice as many additional grams of soda and SSBs when they consumed fast food AFH vs at home; this is a major public health concern given that soda consumption constitutes empty calories and has been related to higher risk of type 2 diabetes mellitus and obesity. Soda excise taxes based on per-unit volume that would particularly affect quantity discounts and free refills or limits on SSB portion sizes, such as the recently proposed policy in New York City, may be effective at curbing excessive SSB consumption in restaurants.

Fast-food restaurants are clustered around schools, particularly high schools and those in low-income neighborhoods, and availability near schools has been associated with higher consumption and weight. Indeed, policies that limit the spatial presence of fast-food restaurants around schools have been suggested and, in fact, bans on fast-food outlets were implemented more broadly in some cities.

Fast-food advertising on television is the most frequently seen category of food-related product advertisements by children and teens, exposure has trended upward substantially, and greater exposure has been associated with higher frequency of consumption and higher body weight. Furthermore, research has shown significant differences by race in exposure to fast-food advertising across brands. Indeed, the present study found that additional fat intake from fast-food consumption was twice as large among black compared with white adolescents, which was similarly observed in a study by Schmidt et al. Only 2 fast-food companies are members of the self-regulatory Children’s Food and Beverage Advertising Initiative and, despite this initiative, the poor nutritional content of fast-food advertising has been well documented. Further consideration should be given to improve the initiative’s nutritional guidelines and to apply it to adolescents.

### Table 4. Regression Estimates of Effect of Fast-Food and Full-Service Restaurant Consumption at Home and Away From Home on Energy, Beverage, and Nutrient Intake for Children and Adolescents

<table>
<thead>
<tr>
<th>Children (age 2-11 y)</th>
<th>Regression Coefficient (SE)</th>
<th>Nutrient Intake</th>
<th>Total Fat, g</th>
<th>Saturated Fat, g</th>
<th>Sodium, mg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fast food away from home</td>
<td>77.31 (28.61)*</td>
<td>91.36 (18.42)*</td>
<td>76.40 (13.61)*</td>
<td>−41.50 (12.62)*</td>
<td>4.00 (2.63)</td>
</tr>
<tr>
<td>Fast food at home</td>
<td>146.72 (28.18)*</td>
<td>83.48 (17.27)*</td>
<td>64.55 (11.45)*</td>
<td>−11.34 (11.24)</td>
<td>7.78 (2.51)*</td>
</tr>
<tr>
<td>Full-service food away from home</td>
<td>200.24 (41.91)*</td>
<td>172.57 (25.17)*</td>
<td>114.47 (18.72)*</td>
<td>−30.16 (14.65)†</td>
<td>18.44 (3.95)*</td>
</tr>
<tr>
<td>Full-service food at home</td>
<td>66.62 (55.76)</td>
<td>49.35 (30.45)</td>
<td>26.55 (20.13)</td>
<td>−23.54 (26.58)</td>
<td>7.66 (4.70)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Adolescents (age 12-19 y)</th>
<th>Regression Coefficient (SE)</th>
<th>Nutrient Intake</th>
<th>Total Fat, g</th>
<th>Saturated Fat, g</th>
<th>Sodium, mg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fast food away from home</td>
<td>285.20 (44.19)*</td>
<td>226.02 (26.39)*</td>
<td>200.20 (22.30)</td>
<td>−65.02 (14.79)*</td>
<td>18.86 (3.52)*</td>
</tr>
<tr>
<td>Fast food at home</td>
<td>297.82 (43.34)*</td>
<td>80.93 (26.87)*</td>
<td>98.73 (20.72)</td>
<td>−11.59 (11.90)</td>
<td>13.05 (3.52)*</td>
</tr>
<tr>
<td>Full-service food away from home</td>
<td>273.84 (53.06)*</td>
<td>142.52 (36.71)*</td>
<td>131.49 (32.47)*</td>
<td>−60.42 (22.44)†</td>
<td>10.32 (4.42)†</td>
</tr>
<tr>
<td>Full-service food at home</td>
<td>238.89 (74.34)*</td>
<td>98.15 (48.55)†</td>
<td>46.50 (39.02)</td>
<td>−23.54 (26.58)</td>
<td>14.58 (3.95)†</td>
</tr>
</tbody>
</table>

Abnormalities: SSB, sugar-sweetened beverage; *, significant at 1%; †, significant at 5%; ‡, significant at 10%.

a All analyses are weighted using the National Health and Nutrition Examination Survey examination weight. SEs were robust. Control variables include indicators for consumption of nonrestaurant food away from home, whether the recall was on a weekday vs the weekend, and whether it was on day 1 vs day 2.
Overall, the findings of higher energy and SSB intake and poorer nutrient intake associated with consuming from restaurants suggest that public policies that aim to reduce restaurant consumption—such as increasing the relative costs of these purchases; limiting access through zoning, particularly around schools; limiting portion sizes; and limiting exposure to marketing—deserve serious consideration. At the same time, regulatory\(^{35,36}\) and voluntary\(^{37,38}\) policies that aim to set standards for the nutritional content of meals obtained from restaurants are increasingly being implemented, and continued efforts are needed to improve and promote healthy food options in restaurants.

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Author Contributions: Dr Powell had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Study concept and design: Powell and Nguyen. Acquisition of data: Powell. Analysis and interpretation of data: Powell and Nguyen. Drafting of the manuscript: Powell. Critical revision of the manuscript for important intellectual content: Powell and Nguyen. Statistical analysis: Powell and Nguyen. Obtained funding: Powell.

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Online-Only Material: Listen to an author interview about this article, and others, at http://bit.ly/MW1VVH.

REFERENCES

35. San Francisco, California, health code article 8, §471.4: setting nutritional standards for restaurant food sold accompanied by toys or other youth focused incentive items. 2011.