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The Impact of Food Away From Home on Adult Diet Quality

Jessica E. Todd, jtodd@ers.usda.gov

Lisa Mancino, lmancino@ers.usda.gov

Biing-Hwan Lin, blin@ers.usda.gov

Abstract

Food away from home (FAFH) has been associated with poor diet quality in many studies. It is difficult, however, to measure the effect of FAFH on diet quality since many unobserved factors, such as food preferences and time constraints, influence not just our choice of where to eat but also the nutritional quality of what we eat. Using data from 1994-96 and 2003-04, this study applies fixed-effects estimation to control for such unobservable influences and finds that, for the average adult, FAFH increases daily caloric intake and reduces diet quality. The effects vary depending on which meals are consumed away from home. On average, breakfast away from home decreases the number of servings of whole grains and dairy consumed per 1,000 calories and increases the percent of calories from saturated and solid fat, alcohol, and added sugar (SoFAAS) in a day. Dinner away from home reduces the number of servings of vegetables consumed per 1,000 calories for the average adult. Breakfast and lunch away from home increase calories from saturated fat and SoFAAS on average more among dieters than among nondieters. Some of the overall negative dietary effects decreased between 1994-96 and 2003-04, including those on whole grain, sodium, and vegetable consumption.

Keywords

Food away from home (FAFH), diet quality, 2005 Healthy Eating Index (HEI-2005), fixed-effects, first-difference, Continuing Survey of Food Intakes by Individuals (CSFII), National Health and Nutrition Examination Survey (NHANES)

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Contents

Summary

Most Americans eat too few fruits, vegetables, and whole grains, but also consume too much saturated fat, sodium, and added sugar. Americans spend a large share of their food budget (42 percent) on food away from home (FAFH), which has been found to be less nutritious than food prepared at home.

What Is the Issue?

Many unobservable factors influence both the choice of what and where to eat, such as individual food preferences, dietary awareness, and time constraints. Not accounting for these unobservable, relevant factors has been shown to overestimate FAFH's impact on caloric intake and overall diet quality. Building on previous work, this report circumvents this issue by using 2 days of dietary intake data from 1994-96 and 2003-04 to estimate how individual changes in the number of meals eaten away from home affect various components of diet quality, such as intake of dairy, vegetables, whole grains, and fat, for the average adult. The analysis allows the effect of FAFH to vary across eating occasions—breakfast, lunch, dinner, or snacks—and compares the impact of FAFH over time and across individual characteristics, such as gender, weight, and dieting practices.

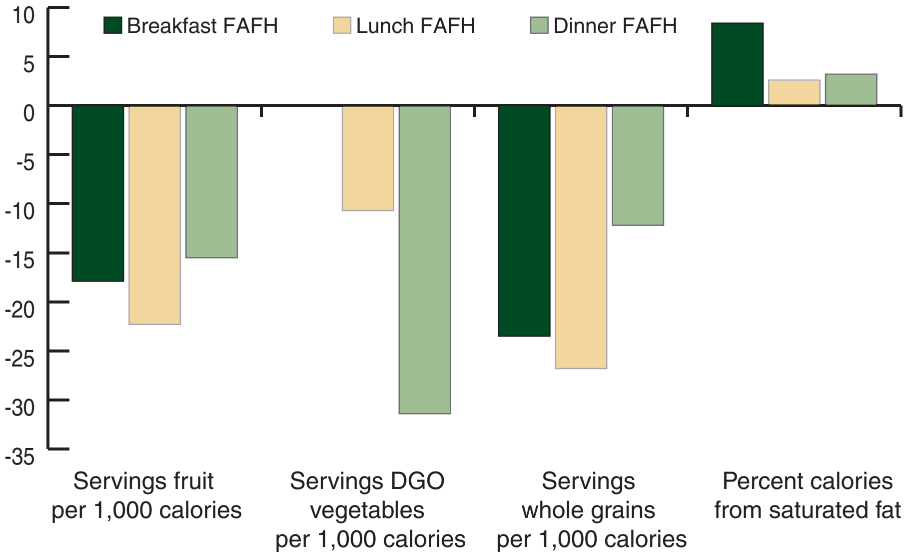
What Did the Study Find?

For the average consumer, eating one meal away from home each week translates to roughly 2 extra pounds each year. Although it is possible to incorporate FAFH into a healthy diet, for the average adult, one additional meal eaten away from home increases daily intake by about 134 calories. In addition, the extra meal way from home lowers diet quality by about two points on the Healthy Eating Index (HEI-2005), enough to shift the average adult's diet quality from a classification of fair to poor.

The impact of FAFH is greatest on the number of servings of fruit, vegetables, whole grains, and dairy per 1,000 calories, but varies according to the meal. On average, the number of servings of fruit per 1,000 calories (dietary density) is reduced by as much as 22.3 percent (from lunch from FAFH), and the effect on the dietary density of whole fruit is even larger (reduced by 31.5 percent). The negative effects on the density of whole grains and dark green and orange vegetables in the diet are similarly large for the average adult (reduced by 26.8 and 31.4 percent, respectively). By comparison, effects on less healthful components (milligrams of sodium per 1,000 calories and percent of calories from saturated fat, solid fat, alcohol, and added sugar) range between 1.9 and 9.3 percent for the average adult.

Some of FAFH's adverse effects on diet quality may be shrinking. On average, the negative impact on the density of whole-grains in the diet from eating breakfast away from home was not as strong in 2003-04 compared with 1994-96. The effect of snacks away from home on the percent of calories from saturated fat intake has also improved for the average adult.

Impact of consuming a meal from FAFH (as compared with food at home) on intake of select HEI-2005 components for the average adult, as percent of mean daily intake



Note: Servings of fruit and DGO vegetables measured in cup equivalents; servings of whole grains measured in ounce equivalents.

FAFH=Food away from home; HEI=Healthy Eating Index; and DGO=Dark green and orange vegetables.

Source: ERS calculations based on 1994-96 Continuing Survey of Food Intakes by Individuals and 2003-04 National Health and Nutrition Examination Survey data.

There are few differences in the effects of FAFH on HEI-2005 components between obese and nonoverweight individuals. These results suggest that portion size and/or a lack of compensation by eating less throughout the rest of the day are likely the main mechanisms by which FAFH increases total caloric intake more among the obese.

How Was the Study Conducted?

This analysis is based on dietary recall data from the 1994-96 Continuing Survey of Food Intakes by Individuals (CSFII) and the 2003-04 National Health and Nutrition Examination Survey (NHANES). Two days of dietary intake data from adults age 20 and older were used to estimate how the number of meals eaten away from home affects daily diet quality for the average adult. A fixed-effects estimator was employed by taking the difference of the 2 days of intake reported for each individual to account for relevant, unobservable factors that influence both FAFH and diet quality. Measures of diet quality include total daily caloric intake; total daily HEI-2005 score; and daily HEI-2005 component dietary densities, such as the number of servings of fruit and vegetables per 1,000 calories.

Introduction

Food away from home (FAFH) comprises a large share of families' food budgets—nearly 42 percent in 2007 (Clauson and Leibtag, 2008). The foods people choose when they eat away from home tend to be higher in total and saturated fat and lower in dietary fiber, calcium, and iron than food prepared at home (Guthrie et al., 2002). As a result, some suggest that FAFH is one cause of poor diet quality and obesity (Binkley, 2008; Binkley et al., 2000; Bowman et al., 2004; Bowman and Vinyard, 2004; Eck-Clemens et al., 1999; Jeffery and French, 1998; Paeratakul et al., 2003).

Recent findings suggest that many estimates of the effect of FAFH on caloric intake or obesity may be too high because factors, such as food preferences, dietary knowledge, and time constraints, were not accounted for (Mancino et al., 2009). Since these factors are usually unobserved, separating their effects from the effects of FAFH can be difficult. In this study, we expanded on the analysis of Mancino et al. (2009), using a fixed-effects estimation to control for time-invariant unobserved factors, to estimate the effect of FAFH on caloric intake, overall diet quality, and also on separate dietary components, such as fruit, dairy, whole grains, and saturated fat.

Previous Research

Numerous studies have investigated the link between the consumption of food away from home and both diet quality and obesity. Much of this research focused on documenting the correlations between FAFH and these outcomes. For example, using a small sample of women participating in a study on the relationship between smoking and energy balance, Eck-Clemens et al. (1999) find that women who eat out more frequently consume more energy, fat, and sodium than those who eat out less often.

Using data from the 1994-96 Continuing Survey of Food Intakes by Individuals (CSFII), Bowman and Vinyard (2004) compare the total energy density (calories per gram of food), as well as intake of total energy, total fat, saturated fat, carbohydrates, and added sugar, between adults who report any fast food consumption and those who consume no fast food over 2 days. Bowman et al. (2004) and Paeratakul et al. (2003) conduct similar comparisons using the same survey data for children. Binkley (2008) use the same data and a similar approach, but analyze separate impacts of fast food and table-service restaurants on calories and grams of food consumed. All four studies find that individuals who report eating fast food have poorer diet quality than those who report not eating fast food. Binkley also find that individuals who eat at a table-service restaurant report greater caloric intake than those who eat at home.

Using data from the 1987 and 1992 National Health Interview Survey (NHIS) and the 1999-2000 National Health and Nutrition Examination Survey (NHANES), Kant and Graubard (2004) find that frequent consumption of commercially prepared meals is associated with higher intake of calories, total fat, and saturated fat, as well as lower intake of carbohydrates, compared with less frequent consumption of such meals. Beydoun et al.

(2008) use CSFII and Diet and Health Knowledge Survey (DHKS) data and find that greater weekly per capita FAFH expenditures is associated with lower diet quality measures, including higher total fat and saturated fat intake, lower fiber intake, and lower HEI scores. This study also finds that the relationship between FAFH and diet quality is significantly correlated with an individual's dietary knowledge, suggesting that consumers make simultaneous decisions about where to eat and what to eat.

To account for this endogeneity, a number of studies limit their comparisons to individuals who consumed food away from home on either the first or second day of the survey, but not on both or neither days (Bowman and Vinyard, 2004; Bowman et al., 2004; Paeratakul et al., 2003; Binkley, 2008). They then compare the mean diet quality on the day that FAFH is consumed with that on the day FAFH is not consumed, assuming that the differences in diet quality across the 2 days estimates the "effect" of FAFH after controlling for individual characteristics that affect preferences for diet quality and FAFH. There are two main problems with this comparison. First, only a small portion of the sample is included in the analysis (due to the requirement that FAFH be consumed on only 1 day). Second, information is lost by treating food away from home as a dichotomous measure, instead of a continuous variable, to represent the intensity of FAFH consumption.

Ebbeling et al. (2004) offer experimental evidence on the effect of fast food on diet quality. Enrolling 54 adolescents age 13-17 in a controlled setting, they find that participants who were told to eat as much or as little fast food as they desired consumed more than 60 percent of their estimated daily energy requirements at a single fast food meal. They also find that overweight participants ate significantly more calories from fast food than healthy weight participants, both in total and as a share of daily requirements. Analysis of dietary recall data on these participants reveals that the overweight participants consumed 409 more total calories on FAFH days than healthy weight participants. This study, however, is limited by its small sample size and exclusive focus on fast food.

A few studies try to identify the causal effect of FAFH using indirect measures of FAFH consumption, such as access to restaurants and prices of both FAFH and food at home (FAH), but their findings are not consistent. For example, Chou et al. (2004) regress individual Body Mass Index (BMI) and obesity status on the State-level number of restaurants and food prices. They find that the availability of restaurants, as measured by the number per capita, explains the majority of the weight increase over time. It is important to note that the supply of restaurants is a function of demand, so their estimates may be biased upward due to the positive correlation between BMI and the demand for FAFH.

Anderson and Matsa (2009) also estimate the effect of access to FAFH, using the distance to an interstate highway to represent access to restaurants. In contrast to Chou et al., Anderson and Matsa find that access to restaurants has no effect on BMI or obesity status. Their study is limited to rural areas in a small number of States and also may suffer from bias due to unobservable factors. For example, people who live farther away from restaurants may treat eating out as more of a special occasion than those who live close. As such, diners who make a special trip to eat away from home may also make more indulgent choices than those who can do so more regularly.

Most recently, Mancino et al. (2009) employ a first-difference estimator on 2 days of dietary recall data collected in the 1994-96 CSFII and the 2003-04 NHANES to estimate the effect of an additional meal from FAFH on energy intake (calories) and diet quality (measured by HEI-2005 score). They compare their first-difference estimates with those from a model that does not control for unobserved individual factors (ordinary least squares or OLS) and find that the OLS estimates are 25 percent higher than the first-difference estimates. We extend this analysis to estimate the effect of FAFH on the intake of components of diet quality, such as fruit, vegetables, dairy, whole grains, and saturated fat.

Data and Sample

Following Mancino et al. (2009), we use data from two national surveys—the 1994-96 CSFII and the 2003-04 NHANES. The CSFII collected 2 nonconsecutive days of dietary recall data between 1994 and 1996 for a nationally representative sample of adults and children. This survey was later merged with the NHANES in 2002, but began releasing both days of dietary intake only in 2003. Thus, the 2003-04 NHANES and 1994-96 CSFII are, to date, the most recent datasets containing 2 days of dietary intake for which a particular measure of diet quality can be constructed. While the 2005-06 NHANES intake data have been released, the corresponding MyPyramid equivalents database has not. In this study, we use the MyPyramid database to evaluate dietary quality and, therefore, do not include the 2005-06 NHANES. We also limit our sample to adults age 20 and older.

The measures of diet quality we examine include total caloric intake, total HEI-2005 score—developed by the U.S. Department of Agriculture's Center for Nutrition Policy and Promotion—and components of the HEI-2005 that Americans either highly under- or over-consume. The HEI-2005 score measures how well an individual's diet adheres to the 2005 Dietary Guidelines for Americans (USDHHS and USDA, 2005; Guenther et al., 2007) and is the sum of an individual's score on 12 components: total fruit (whole fruit and fruit juice); whole fruit; total vegetables; dark green and orange vegetables and legumes; total grains; whole grains; dairy; meat and beans; oils; saturated fat; sodium; and solid fat, alcohol, and added sugar (SoFAAS).

The HEI-2005 component scores are based on how well the density of the component in the diet (the quantity of servings consumed per 1,000 calories), or the percent of total calories consumed, meets the recommendations in the Dietary Guidelines. For fruit, vegetables, and dairy, the component scores are based on the cup equivalents per 1,000 calories, while for grains and meat and beans, the scores are based on ounce equivalents consumed per 1,000 calories.[1] For oils and sodium, the component scores are based on the grams (or milligrams) per 1,000 calories consumed. We refer to these density measures as dietary densities through the remainder of the report. For saturated fat and SoFAAS, the component scores are based on the percent of daily calories coming from the respective component. For this analysis, we

[1] Since specific foods in each food group come in different forms, the Center for Nutrition Policy and Promotion calculates the cup or ounce equivalent of each component individuals report consuming. For example, whole grains can be consumed as bread, pasta, rice, muffins, or other baked goods. The total ounces of whole grains consumed will depend on the specific food. See http://www.mypyramid.gov/pyramid/index.html for more information about cup and ounce equivalents.

focus on the components where current dietary intake is lacking (total fruit, whole fruit, total vegetables, dark green and orange vegetables, whole grains, and dairy), and where current intake is excessive (saturated fat, sodium, and SoFAAS) (Guenther et al., 2008).

Following Mancino et al. (2009), we classify each meal as either a breakfast, lunch, dinner, or snack according to the respondent's definition of the eating occasion. Meals are then classified as FAFH if the majority of calories in that meal, excluding beverages, came from fast food, table-service

Table 1
Summary statistics for adults age 20 and over, 1994-96 and 2003-04 data pooled (N = 13,429)

	Daily means avereaged over 2 days of intake		Difference between days (day 2 –day 1)	
	Mean	*Standard error*	*Mean*	*Standard error*
Dependent variables				
Energy (kcal)	2087.02	13.35	-81.40	10.89
HEI-2005	51.50	0.33	0.90	0.18
Fruit density (cup equivalents per 1,000 kcal)	0.53	0.02	0.03	0.01
Whole fruit density (cup equivalents per 1,000 kcal)	0.34	0.01	0.03	0.01
Whole grain density (ounce equivalents per 1,000 kcal)	0.37	0.01	0.03	0.01
Dairy density (cup equivalents per 1,000 kcal)	0.71	0.01	0.02	0.01
Vegetable density (cup equivalents per 1,000 kcal)	0.89	0.01	0.04	0.01
DGO density (cup equivalents per 1,000 kcal)	0.14	0.00	0.01	0.00
Percent saturated fat (percent of calories)	11.12	0.08	0.02	0.07
Sodium density (milligrams per 1,000 kcal)	1668.27	8.40	51.98	9.88
Percent SoFAAS (percent of calories)	35.93	0.28	-1.34	0.18
Explanatory variables				
Respondent ate breakfast	0.84	0.01	0.02	0.01
Respondent ate lunch	0.77	0.01	0.02	0.01
Respondent ate dinner	0.92	0.00	0.01	0.01
Number of snacks consumed	1.39	-0.15	0.02	0.01
Number of meals from food away from home	0.67	0.01	-0.03	0.01
Respondent ate breakfast from food away from home	0.08	0.00	0.00	0.00
Respondent ate lunch from food away from home	0.25	0.01	0.01	0.01
Respondent ate dinner from food away from home	0.22	0.00	-0.02	0.01
Number of snacks from food away from home	0.10	0.00	-0.02	0.01
Demographic subgroups				
Male	0.48	0.01	—	—
Observed in 2003-04	0.53	0.02	—	—
Obese (BMI >=30)[1]	0.24	0.01	—	—
Not overweight (BMI <25)[1]	0.42	0.01	—	—
Perceived overweight[2]	0.54	0.01	—	—
On a low-calorie or low-fat diet	0.10	0.00	—	—

[1] Sample size = 13,118.
[2] Sample size = 9,755.

Notes: Weighted means reported; Stata 10.1 is used to incorporate the complex survey design to adjust the standard errors. Density measures follow construction by U.S. Department of Agriculture's Center for Nutrition Policy and Promotion. The HEI-2005 score is the sum of component scores, based on the number of serving sizes (cups or ounces) consumed per 1,000 calories. See http://www.mypyramid.gov/pyramid/index.html for more information.

SoFAAS=Solid fat, alcohol, and added sugar; HEI=Healthy Eating Index; DGO=Dark green and orange vegetables; and BMI=Body mass index.

Source: ERS calculations based on 1994-96 Continuing Survey of Food Intakes by Individuals and 2003-04 National Health and Nutrition Examination Survey data.

restaurants, cafeterias, or taverns.[2] Based on the day of the intake recall, we identify whether an intake day occurred on a weekend (Saturday or Sunday). Two-day sample means for our explanatory, dependent, and selected demographic variables are reported in table 1. Our data construction differed slightly from Mancino et al. (2009) in that we allow for only one meal each to be consumed as breakfast, lunch, or dinner, but snacks are counted as often as reported. We use the survey commands in Stata 10.1 to report weighted means and to adjust the standard errors to account for the complex survey design in all regressions. As we will explain later, the demographic variables are used to test whether the effect of food away from home varies by population subgroups. These summary statistics show that, after pooling both surveys, the average respondent consumes 2,087 calories and eats less than 1 meal away from home (0.67) per day. The average daily HEI-2005 score is 51.5 points out of a possible 100, indicating the average respondent's diet is just slightly better than one that is classified as "poor." Forty-two percent of the sample are not overweight or obese (BMI<25), while 24 percent are obese (BMI>30), based on self-reported height and weight.

[2] Some meals contained foods from multiple sources. For example, an individual may have brought a lunch from home, but purchased dessert from the work cafeteria.

Table 2 lists the recommended dietary density (or percent of calories) that results in the maximum score for the component, the weighted sample mean, and the percent change needed to reach recommended intake levels for the average adult for each component we examine. The deficiency in average dietary density, as a percent of recommended levels, is greatest for whole grains (75.3 percent). On average, total vegetable dietary density is almost at recommended levels, however, the average American adult needs to increase his/her average dietary intake by 19 percent to meet recommendations. The dietary density of highly nutritious dark green and orange vegetables is well below recommended levels (average density needs to increase by 65 percent). The density of fruit and dairy in the diet needs to increase by more than 33 and 45 percent, respectively. Americans need to decrease the percent of calo-

Table 2
Changes in average daily intake needed to meet dietary recommendations

HEI-2005 component	Intake per 1,000 calories for maximum score	Mean intake per 1,000 calories	Percent change in average intake to reach maximum
Total fruit	≥ 0.8 cup equivalents	0.53	33.8
Whole fruit	≥ 0.4 cup equivalents	0.34	15.0
Whole grains	≥ 1.5 ounce equivalents	0.37	75.3
Dairy	≥ 1.3 cup equivalents	0.71	45.4
Total vegetable	≥ 1.1 cup equivalents	0.89	19.1
DGO	≥ 0.4 cup equivalents	0.14	65.0
Percent saturated fat *	≤ 7 percent	11.12	-58.9
Sodium	≤ 700 milligrams	1668.27	-138.3
Percent SoFAAS *	≤ 20 percent	35.93	-79.7

Notes: Densities are per 1,000 kcal, weighted means reported, adults age 20 and older with 2 days of dietary intake reported. See http://www.mypyramid.gov/pyramid/index.html for more information about cup and ounce equivalents.

* Intake is percent of total energy.

HEI=Healthy Eating Index; DGO=Dark green and orange vegetables; and SoFAAS=Solid fat, alcohol, and added sugar.

Source: Guenther et al. (2007) and ERS calculations using data from the 1994-96 Continuing Survey of Food intakes by individuals and 2003-04 National Health and Nutrition Examination Survey.

ries from saturated fat (by 59 percent of the recommended level), the percent of calories from SoFAAS (by 80 percent), and the density of sodium (by 138 percent) to meet recommended levels.

Estimation Approach

A major challenge in estimating the effect of food away from home on caloric intake and diet quality is that many of the factors that influence general food choices and diet quality, such as food preferences, dietary knowledge, and time constraints, also influence the choice to consume FAFH. Moreover, these same factors are typically unobservable to researchers, as is the case with the CSFII and NHANES.

Following Mancino et al. (2009), we employ a first-difference estimator (which is equivalent to a fixed-effects model when there are only two observations per person) using observations for the 2 different intake days[3]:

$$\Delta DQ_i = \gamma(\Delta FAFH_i) + \sum_{j=1}^{4} \phi_j (\Delta MEAL_{ij}) + \beta (\Delta weekend_i) + \Delta\varepsilon_i \qquad \text{Equation 1}$$

where each j represents a particular meal (breakfast, lunch, dinner, or snack). Taking the difference between the 2 days of intake (ΔDQ_i) removes the effect of time-invariant observed characteristics (e.g., age and gender) and unobserved characteristics (e.g., food preferences and dietary knowledge) from the remaining parameter estimates. Thus, γ provides an estimate of the average effect of obtaining one additional meal from FAFH on diet quality when all time-invariant factors have been accounted for.[4] We include changes in meal patterns ($\Delta MEAL_{ij}$), such as whether an individual ate breakfast or consumed fewer snacks, and whether the recall day was on a weekend ($\Delta weekend_i$). We hypothesize that such changes may alter daily eating patterns and food consumption. Explicitly modeling these changes may also help to control for unobserved factors that vary over time, such as fluctuations in an individual's daily schedule, social obligations, or appetite. Thus, the ϕ_j estimate the average effects of eating particular meals or a snack on diet quality, and β estimates the change in the outcome attributable to the difference between weekday and weekend consumption patterns.

Identifying particular meals where the effects of eating away from home are particularly strong can help policymakers design more effective interventions to improve decisionmaking. To do this, we replace the change in the total number of meals from FAFH in equation 1 with the interaction of an indicator for each specific meal and whether that meal was consumed from FAFH:

$$\Delta DQ_i = \sum_{j=1}^{4} \theta_j (\Delta MEAL_{ij}) * (FAFH_{ij}) + \sum_{j=1}^{4} \phi_j (\Delta MEAL_{ij}) + \beta (\Delta weekend_i) + \Delta\varepsilon_i \qquad \text{Equation 2}$$

In equation 2, each θ_j estimates the average effect of consuming a particular meal from FAFH on diet quality. All other parameters are the same as in equation 1.

[3] The fixed-effects estimator has been used extensively to remove bias from unobservable factors (see, for example, Hersch and Stratton (1997), who estimate the effect of housework time on wages, and Behrman and Deolalikar (1990), who estimate the effect of income on nutrient demand).

[4] The breakfast, lunch, and dinner variables are all dichotomous. They indicate whether an individual ate a specific meal on that intake day. Thus, the differenced values used in our estimates take on values of -1, 0, or 1. The snack variable is continuous and the difference variable indicates the change in number of snacks between the 2 days of intake.

After obtaining estimates with the pooled data, we estimate equation 2 for the HEI-2005 components separately for both the 1994-96 and 2003-04 samples to detect whether the effect of eating out on diet quality increased or decreased over time. Changes in locality-specific regulations for restaurants (such as nutrition labeling) and voluntary menu modifications may have changed the restaurant environment during that time. In addition, greater attention by the popular media on the potential negative effects of food away from home may have altered the choices consumers make when eating out, which, in turn, may have changed the average effect FAFH has on diet quality. Mancino et al. (2009) find that dinner away from home has a greater impact on total daily caloric intake in 2003-04 compared with 1994-96. We test for differences in effects on the HEI-2005 components to see if FAFH's effect on specific aspects of diet quality has changed.

We also test to see if FAFH's impact on dietary component intake varies significantly between men and women, as past studies have found dietary patterns differ significantly by gender (Binkley et al., 2000; Kuchler and Lin, 2002). Thus, we estimate equation 2 separately for each gender. We also investigate whether the impact of food away from home varies across other individual characteristics, such as obesity status or concern about dieting and weight loss. These factors may modify how an individual makes choices when eating FAFH or compensates for those choices when eating meals from food at home. Specifically, we compare obese individuals (BMI of at least 30) with nonoverweight individuals (BMI of less than 25). We use these categories because BMI is not always an accurate gauge of adiposity (fat). For example, individuals with large muscle mass may be classified as overweight (BMI of 25 or more, but less than 30), but are actually quite fit. We also compare individuals who perceive themselves to be overweight with those who do not and compare individuals on a low-fat or low-calorie diet with nondieters. We hypothesize that individuals who may have more motivation to watch their caloric intake will be more likely to make healthy choices when eating food away from home.

Effect of FAFH on Diet Quality

People Eat More Calories and Have a Lower Total HEI-2005 Score on the Days They Eat at Least One Meal Away from Home

Our results for energy and total HEI-2005 score are similar to Mancino et al. (2009). After controlling for the endogeneity issue through first-difference estimation, each meal away from home is estimated to add 134 calories to total daily intake and to lower HEI-2005 scores by almost 2 points for the average adult (table 3). We also find that these estimates are smaller (by about 21 to 24 percent) than those obtained from an OLS regression, which does not account for endogeneity (results available upon request). Our first-difference estimates are also substantially smaller than those in studies that estimate the effect of fast-food alone on an adult's daily total caloric intake, which ranges from 205 to more than 350 calories per day (Binkley et al., 2000; Bowman and Vinyard, 2004; Paeratukul et al., 2003) Again, our smaller coefficients suggest less bias from unobserved differences in preferences for both diet quality and FAFH.

Using the estimated impact of FAFH on daily calories, we extrapolate an upper bound estimate of the average effect of FAFH on weight over time. The extra 134 calories from 1 additional meal away from home each week, all things being equal, translates to roughly 2 extra pounds each year.[5] This estimate is likely an upper bound because it assumes that energy needs and all other consumption remain the same. Individuals may increase physical activity, however, to compensate for the additional energy intake. Moreover, as one gains weight, the energy required to maintain that weight increases, reducing the effect of the additional 134 calories on weight gain.

[5] This assumes that an extra 3,500 calories results in 1 pound of additional weight.

Table 3
Effect of meals from FAFH on energy and HEI-2005 for adults

	Equation 1		Equation 2	
	Energy	HEI-2005	Energy	HEI-2005
Number of FAFH meals eaten	133.735*** (12.926)	-1.968*** (0.225)		
Breakfast from FAFH	—	—	73.976* (40.527)	-4.533*** (0.731)
Lunch from FAFH	—	—	158.230*** (16.888)	-1.965*** (0.418)
Dinner from FAFH	—	—	143.958*** (26.204)	-1.864*** (0.407)
Snacks from FAFH	—	—	106.587*** (38.206)	-1.104*** (0.388)
Respondent ate breakfast	218.420*** (41.794)	2.148*** (0.561)	222.565*** (42.026)	2.526*** (0.525)
Respondent ate lunch	230.748*** (25.686)	2.062*** (0.451)	213.857*** (25.262)	2.011*** (0.425)
Respondent ate dinner	356.837*** (40.415)	3.191*** (0.514)	352.474*** (40.086)	3.187*** (0.483)
Number of snacks eaten	155.801*** (9.610)	0.228 (0.139)	157.210*** (10.076)	0.170 (0.148)
Recall was weekend day	108.660*** (17.722)	-1.328*** (0.368)	110.247*** (17.538)	-1.302*** (0.367)
Constant	-65.707*** (10.689)	0.772*** (0.172)	-66.078*** (10.604)	0.778*** (0.174)
Observations	13,429	13,429	13,429	13,429
R-squared	0.10	0.03	0.09	0.04

Notes: Standard errors in parentheses; *** p<0.01, ** p<0.05, and * p<0.1. Stata 10.1 is used to apply sample weights and to adjust standard errors to incorporate the complex survey design.

FAFH=Food away from home; and HEI=Healthy Eating Index.

Source: ERS calculations based on 1994-96 Continuing Survey of Food Intakes by individuals and 2003-04 National Health and Nutrition Examination Survey data.

Estimates from the model specified in equation 2 indicate that lunch away from home has the largest impact on total daily intake by adding 158 calories. Dinner away from home adds 144 calories, while breakfast adds only 74 additional calories to total daily energy intake (table 3). Breakfast has the largest negative impact on an average individual's total HEI score (-4.5 points, a decrease of 9 percent from the mean of 51.5). Snacking away from home also has a large impact on calories. Each snack away from home adds 107 calories to daily intake.

Impact of FAFH Meals Is Greatest for Fruit, Whole Grain, Dairy, and Vegetable Intake

We see that, as a percent of average dietary density, the effects on fruit, whole grain, dairy, and vegetable intake are quite large (table 4). The density of fruit in the diet is reduced by 17.9 percent when breakfast is from FAFH, by 22.3 percent when lunch is from FAFH, and by 15.5 percent when dinner

Table 4
Coefficient estimates and effect, as percent of sample means, of specific meals consumed from FAFH on HEI-2005 component densities, first-difference model

Meal	Fruit density	Whole fruit density	Whole grain density	Dairy density	Vegetable density	DGO density	Percent saturated fat	Sodium density	Percent SoFAAS
					Percent change from mean				
Breakfast away from home	-17.9	-22.6	-23.5	-11.8	ns	ns	8.4	ns	9.3
Lunch away from home	-22.3	-31.5	-26.8	-8.6	ns	-10.7	2.6	-3.3	1.9
Dinner away from home	-15.5	-16.5	-12.2	ns	-8.7	-31.4	3.2	ns	5.4
Snacks away from home	-9.1	-10.6	ns	ns	ns	ns	ns	ns	3.6
					Estimated coefficients				
Breakfast away from home	-0.095*** (0.027)	-0.077*** (0.022)	-0.087*** (0.019)	-0.084** (0.032)	-0.010 (0.026)	0.000 (0.008)	0.939*** (0.232)	17.471 (34.724)	3.334*** (0.789)
Lunch away from home	-0.118*** (0.020)	-0.107*** (0.017)	-0.099*** (0.011)	-0.061** (0.025)	0.008 (0.020)	-0.015* (0.008)	0.294** (0.128)	-54.881** (23.748)	1.775*** (0.284)
Dinner away from home	-0.082*** (0.018)	-0.056*** (0.019)	-0.045*** (0.015)	0.035 (0.024)	-0.077*** (0.023)	-0.044*** (0.007)	0.354*** (0.118)	-2.176 (23.490)	1.933*** (0.355)
Snacks away from home	-0.048** (0.021)	-0.036** (0.016)	-0.020 (0.021)	-0.036 (0.023)	0.003 (0.020)	0.004 (0.009)	-0.050 (0.117)	9.328 (22.705)	1.302*** (0.373)

Notes: Standard errors in parentheses; *** p<0.01, ** p<0.05, and * p<0.1. Additional controls include the change in whether the respondent ate breakfast, lunch and dinner on the given day, the change in the number of snacks consumed and whether the recall day was on a weekend. N = 13,429 for all regressions. Percentage changes are based on means reported in table 1. Stata 10.1 is used to apply sample weights and to adjust standard errors to incorporate the complex survey design.

ns=Estimated coefficient not significant and no percentage change was calculated.

DGO=Dark green and orange vegetables; and SoFAAS=Solid fat, alcohol, and added sugar.

Source: ERS calculations based on 1994-96 Continuing Survey of Food Intakes by Individuals and 2003-04 National Health and Nutrition Examination Survey data.

is from FAFH. Each snack from FAFH reduces the measure by 9.1 percent. The negative effects of food away from home on whole fruit are even larger: 22.6 percent (breakfast), 31.5 percent (lunch), 16.5 percent (dinner), and 10.6 percent (snack). The negative effect of breakfast, lunch, and dinner from FAFH on whole grain intake is similarly large, reducing the density in the diet by 23.5, 26.8, and 12.2 percent, respectively. The density of dairy in the diet is reduced by breakfast (11.8 percent) and lunch (8.6 percent) from FAFH. Dinner from FAFH reduces the density of total vegetables in the diet more than any other meal (by 8.7 percent), while both lunch and dinner reduce the density of dark green and orange vegetables in the diet (10.7 and 31.4 percent, respectively).

The effects on components that currently exceed dietary recommendations (saturated fat, sodium, and SoFAAS) are not as large. Breakfast, lunch, and dinner from FAFH increase the percent of calories from saturated fat by 8.4, 2.6, and 3.2 percent, respectively. Consumption of any meal or snack from FAFH increases the percent of calories from SoFAAS, with breakfast having the largest effect (9.3 percent increase) and lunch having the smallest (1.9 percent). Comparing the effects of meals from FAFH with the gaps between recommended and average dietary density (see table 2) suggests that FAFH consumption may limit our ability to close the gaps between recommended and actual dietary density for fruit, whole grains, dairy, and vegetables.

Some of FAFH's Adverse Effects on Diet Quality May Be Shrinking

Our comparison of the effects of FAFH in 1994-96 and 2003-04 reveals that some of the negative impacts of FAFH on diet quality have diminished over time (table 5). Eating breakfast from food away from home has less of a negative impact on whole-grain intake in 2003-04 than in 1994-96. This improvement may be due to an increasing supply of whole-grain foods over time (Mancino et al., 2008). The impact of snacks from food away from home on the percent of calories from saturated fat has also improved, as has the impact of dinner from food away from home on the density of dairy in the diet and the share of calories from SoFAAS. In addition to possible changes in the types of foods available, this improvement in the effect of FAFH on diet quality may also be due to changes in the types of foods individuals select when eating FAFH. The one exception to the reduced negative impact of FAFH in 2003-04 is the effect on sodium. In 1994-96, lunch and dinner away from home reduced the density of sodium in the diet, but by 2003-04, this effect no longer holds true. This change may indicate higher levels of sodium in FAFH in recent years, or it could indicate that individuals are choosing more low-sodium foods at home, eliminating the effect on sodium intake from FAFH.

Effect of FAFH on Calories and Diet Quality Is Roughly the Same for Men and Women

The main differences we find between men and women are for fruit, vegetables, and whole grains (table 6). For both men and women, consuming lunch or dinner from FAFH reduces the density of fruit and whole fruit in the diet, but the effect is larger for women than men. We see a similar comparison

Table 5
Effect of FAFH meals on HEI-2005 component densities, by survey year, first-difference estimates

Item	Breakfast from FAFH		Lunch from FAFH		Dinner from FAFH		Snacks from FAFH	
	2003-04	1994-96	2003-04	1994-96	2003-05	1994-96	2003-05	1994-96
Fruit density	-0.104**	-0.084**	-0.134***	-0.097***	-0.081***	-0.081***	-0.054	-0.046**
Whole fruit density	-0.087**	-0.064**	-0.121***	-0.086***	-0.050	-0.062***	-0.057	-0.024
Whole grain density	**-0.044**	**-0.140*** **	-0.081***	-0.118***	-0.041*	-0.046**	-0.048	-0.003
Dairy density	-0.064	-0.107***	-0.048	-0.070***	**0.088** **	**-0.025**	-0.083	-0.006
Vegetable density	0.011	-0.032	0.025	-0.013	-0.061	-0.089***	0.015	-0.004
DGO density	0.006	-0.007	-0.017	-0.013	-0.043***	-0.041***	0.010	0.000
Percent saturated fat	0.813*	1.107***	0.256	0.356***	0.312	0.391***	**-0.457***	**0.181**
Sodium density	8.820	29.895	-16.386	-102.601***	38.271	-45.972	33.455	-3.454
Percent SoFAAS	3.612**	3.014***	1.638***	1.921***	**1.177** **	**2.692*** **	1.102	1.378***

Notes: Coefficient is significant at *** p<0.01, ** p<0.05, and * p<0.1. Difference between 2003-04 and 1994-96 is significant at p<0.01 (shaded), p<0.05 (bold), and p<0.1 (underlined). Stata 10.1 is used to apply sample weights and to adjust standard errors to incorporate the complex survey design..

FAFH=Food away from home; DGO = Dark green and orange vegetables; and SoFAAS=Solid fat, alcohol, and added sugar.

Source: ERS calculations based on 1994-96 Continuing Survey of Food Intakes by Individuals and 2003-04 National Health and Nutrition Examination Survey data.

Table 6
Effect of FAFH meals on HEI-2005 component densities, by gender, first-difference estimates

Item	Breakfast from FAFH		Lunch from FAFH		Dinner from FAFH		Snacks from FAFH	
	Women	Men	Women	Men	Women	Men	Women	Men
Fruit density	-0.070*	-0.114**	-0.151***	-0.081***	-0.108***	-0.051**	-0.040	-0.055*
Whole fruit density	-0.076*	-0.076***	**-0.142*** **	**-0.066*** **	-0.078***	-0.031	-0.064***	-0.017
Whole grain density	-0.037	-0.125***	-0.087***	-0.114***	-0.037	-0.055***	-0.033	-0.009
Dairy density	-0.046	-0.115***	-0.056*	-0.063**	0.021	0.050**	-0.019	-0.048
Vegetable density	0.007	-0.026	0.022	-0.002	**-0.122*** **	**-0.031**	**-0.019**	**0.021**
DGO density	0.019	-0.015*	-0.011	-0.017*	-0.063***	-0.023**	0.017	-0.007
Percent saturated fat	1.045***	0.839***	0.315*	0.272	0.237	0.476***	0.203	-0.257
Sodium density	18.598	16.583	-22.027	-94.280***	18.830	-23.738	-7.363	26.055
Percent SoFAAS	3.697***	2.957***	2.099***	1.405***	2.070***	1.802***	1.339	1.330***

Notes: Coefficient is significant at *** p<0.01, ** p<0.05, and * p<0.1. Difference between male and female is significant at p<0.01 (shaded), p<0.05 (bold), and p<0.1 (underlined). Stata 10.1 is used to apply sample weights and to adjust standard errors to incorporate the complex survey design.

FAFH=Food away from home; HEI=Healthy Eating Index; DGO=Dark green and orange vegetables; and SoFAAS=Solid fat, alcohol, and added sugar.

Source: ERS calculations based on 1994-96 Continuing Survey of Food Intakes by Individuals and 2003-04 National Health and Nutrition Examination Survey data.

for dark green and orange vegetables at dinner—eating dinner from FAFH reduces the density in the diet for both men and women, but the impact is more pronounced for women. In contrast, men reduce the density of whole grains more than women when they eat breakfast from food away from home.

Few Differences Exist in the Effects of FAFH on HEI Components for Individuals with Different Weight Status

Although Mancino et al. (2009) found that FAFH has greater effects on caloric intake for obese individuals than nonoverweight individuals—and similarly, for those who reported being on a low-fat or low-calorie diet as compared with nondieters—we find few differences in the effects on HEI-2005 components for these groups. Snacks from FAFH reduce the density of whole grains in the diet and dinner from FAFH reduces the density of sodium in the diet for obese individuals, but not for those with BMI less than 25 (table 7). Mancino et al. (2009) find that FAFH has a less negative effect on the total HEI-2005 score for individuals who perceive themselves to be overweight than for those who believe their weight to be in the healthy range. However, when we examine the specific components, we find only one significant difference: A snack from FAFH reduces the density of whole-grains in the diet for those who perceive themselves as overweight, but not for those who perceive their weight to be in the healthy range (table 8). This finding suggests that the difference in overall caloric intake from FAFH found by Mancino et al. (2009) may be mainly due to larger portion sizes and/or lack of compensation throughout the day (such as reducing caloric intake at other meals) rather than choosing less healthy foods when eating away from home.

Even Dieters Get Into Trouble When Eating Away from Home

In contrast to our comparisons by weight status, we find significant differences in the impact of FAFH on the HEI-2005 component densities for dieters compared with nondieters (table 9). Interestingly, we find that the adverse impact of FAFH is significantly greater for individuals on a diet. Specifically, eating breakfast or lunch from FAFH increases the percent of calories from saturated fat, and eating breakfast or snacks from FAFH increases the percent of calories from SoFAAS, more for dieters than for nondieters. In addition, eating lunch or dinner from FAFH has a larger negative effect on the density of whole fruit in the diet, and lunch away from home has a larger negative effect on the density of dairy for dieters. These differences may indicate that dieters have more trouble choosing healthy food when eating away from home or that they are more likely to splurge in a more tempting environment. Alternatively, these differences may be due to the fact that dieters choose the same foods as nondieters when eating FAFH, but their food consumption at home is much healthier than that of nondieters.

Table 7
Effect of FAFH meals on HEI-2005 component densities, by weight status, first-difference estimates

Item	Breakfast from FAFH		Lunch from FAFH		Dinner from FAFH		Snacks from FAFH	
	BMI < 25	Obese	BMI < 25	Obese	BMI < 25	Obese	BMI < 25	Obese
Fruit density	-0.030	-0.149***	-0.115***	-0.095***	-0.115***	-0.072	-0.054*	-0.038
Whole fruit density	-0.028	-0.123***	-0.116***	-0.081***	-0.077***	-0.044	-0.047*	-0.026
Whole grain density	-0.072**	-0.101**	-0.132***	-0.102***	-0.032	-0.095***	0.028	-0.103***
Dairy density	-0.072	-0.023	-0.097***	-0.045	0.022	0.055*	-0.037	-0.066
Vegetable density	-0.018	0.029	0.048	0.002	-0.082***	-0.080**	-0.029	-0.010
DGO density	-0.013	0.018	-0.008	-0.018	-0.055***	-0.030**	0.013	-0.001
Percent saturated fat	0.985***	1.321***	0.251	0.365	0.325	0.350	0.067	0.119
Sodium density	46.990	-45.812	-14.155	-82.840	29.345	-66.115*	-9.524	11.624
Percent SoFAAS	3.718***	3.831**	2.024***	1.321*	1.836***	2.097***	1.274*	0.594

Notes: Coefficient is significant at *** p<0.01, ** p<0.05, and * p<0.1. Difference between subgroups is significant at p<0.01 (shaded), p<0.05 (bold), and p<0.1 (underlined). Stata 10.1 is used to apply sample weights and to adjust standard errors to incorporate the complex survey design.

FAFH=Food away from home; HEI=Healthy Eating Index; BMI=Body mass index; DGO=Dark green and orange vegetables; and SoFAAS=Solid fat, alcohol, and added sugar.

Source: ERS calculations based on 1994-96 Continuing Survey of Food Intakes by Individuals and 2003-04 National Health and Nutrition Examination Survey data.

Table 8
Effect of FAFH meals on HEI-2005 component densities, by perceived weight status, first-difference estimates

Item	Breakfast from FAFH		Lunch from FAFH		Dinner from FAFH		Snacks from FAFH	
	Perceived healthy weight	Perceived overweight	Perceived healthy weight	Perceived overweight	Perceived healthy weight	Perceived overweight	Perceived healthy weight	Perceived overweight
Fruit density	-0.027	-0.132***	-0.131***	-0.116***	-0.094***	-0.074**	-0.077**	-0.033
Whole fruit density	-0.017	-0.113***	-0.116***	-0.104***	-0.075***	-0.037	-0.056**	-0.033
Whole grain density	-0.088**	-0.069**	-0.118***	-0.083***	-0.058**	-0.056***	0.009	-0.082*
Dairy density	-0.132*	-0.038	-0.046	-0.072*	0.057	0.048	-0.065	-0.054*
Vegetable density	0.027	0.018	0.059	-0.015	-0.080***	-0.093**	0.000	0.024
DGO density	-0.010	0.018	-0.015	-0.012	-0.039***	-0.053***	0.018	0.001
Percent saturated fat	0.914**	0.993***	0.275	0.217	0.563**	0.150	-0.230	-0.287
Sodium density	7.860	14.240	-39.323	-49.352	-10.512	21.232	9.280	34.721
Percent SoFAAS	4.172***	2.539**	2.181***	1.359**	2.208***	1.567**	0.992	1.493**

Notes: Coefficient is significant at *** p<0.01, ** p<0.05, and * p<0.1. Difference between subgroups is significant at p<0.01 (shaded), p<0.05 (bold), and p<0.1 (underlined). Stata 10.1 is used to apply sample weights and to adjust standard errors to incorporate the complex survey design.

FAFH=Food away from home; HEI=Healthy Eating Index; DGO=Dark green and orange vegetables; and SoFAAS=Solid fat, alcohol, and added sugar.

Source: ERS calculations based on 1994-96 Continuing Survey of Food Intakes by Individuals and 2003-04 National Health and Nutrition Examination Survey data.

Table 9
Effect of FAFH meals on HEI-2005 component densities, by dieting status, first-difference estimates

Item	Breakfast from FAFH		Lunch from FAFH		Dinner from FAFH		Snacks from FAFH	
	Nondieters	Dieters	Nondieters	Dieters	Nondieters	Dieters	Nondieters	Dieters
Fruit density	-0.076**	-0.249*	-0.113***	-0.166***	-0.074***	-0.154**	-0.054**	-0.015
Whole fruit density	-0.060**	-0.215	-0.098***	-0.183***	-0.046***	-0.145**	-0.041**	-0.000
Whole grain density	-0.092***	-0.044	-0.093***	-0.151**	-0.043***	-0.065	-0.019	-0.020
Dairy density	-0.092**	0.015	-0.044*	-0.208**	0.035	0.028	-0.038	-0.002
Vegetable density	-0.003	-0.064	0.004	0.044	-0.065**	-0.195*	0.012	-0.094
DGO density	-0.000	0.002	-0.016*	-0.002	-0.041***	-0.068**	0.007	-0.026
Percent saturated fat	**0.837*** **	**2.026*** **	**0.213**	**0.983*** **	0.364***	0.261	-0.107	0.618
Sodium density	27.117	-66.197	-45.503	-135.063**	3.379	-54.370	8.477	-6.115
Percent SoFAAS	**3.036*** **	**6.073*** **	1.751***	2.198**	1.880***	2.565*	1.136***	3.327***

Notes: Coefficient is significant at *** p<0.01, ** p<0.05, and * p<0.1. Difference between subgroups is significant at p<0.01 (shaded), p<0.05 (bold), and p<0.1 (underlined). Stata 10.1 is used to apply sample weights and to adjust standard errors to incorporate the complex survey design.

FAFH=Food away from home; HEI=Healthy Eating Index; DGO=Dark green and orange vegetables; and SoFAAS=Solid fat, alcohol, and added sugar.

Source: ERS calculations based on 1994-96 Continuing Survey of Food Intakes by Individuals and 2003-04 National Health and Nutrition Examination Survey data.

Discussion

This analysis shows that FAFH is a contributing factor to poor diet quality and that concern about FAFH's effect on obesity is warranted. Even after controlling for individual differences in dietary awareness and food preferences, we still find that people choose less healthful foods when eating away from home. Our findings also suggest that individuals do not compensate for their less nutritious food-away-from-home choices by making healthier food choices at home.

Consumers may simply have strong preferences for less healthful food when eating away from home. However, if individuals unknowingly eat less healthfully when eating food away from home and do not compensate for the indulgence over the rest of the day, then increasing the availability of nutritional information for FAFH may make it easier for people to act on their own dietary intentions. If carefully selected, FAFH may be part of a healthy and affordable diet (You et al., 2009). The fact that dieters suffer larger negative effects from FAFH than nondieters suggests that nutritional information in restaurants or more healthy choices on menus may benefit this group especially. Educating consumers about healthful FAFH choices could have significant payoff, especially if self-control is exacerbated when eating away from home (Cutler et al., 2003; Mancino and Kinsey, 2008). Universal nutrition labeling and nutrition education, however, are not likely to be a panacea unless individuals are motivated to use the information. As we have seen in the food-at-home sector, not all adults use nutrition labels, and the rate of label use has declined recently (Todd and Variyam, 2008).

With more attention on FAFH's possible negative impact on diet quality and weight gain, many restaurants have voluntarily added healthier items to their menus or have provided nutritional information to their customers (CSPI, 2003; Warner, 2005). The availability of healthier options, as well as additional information, may help individuals to make food choices more consistent with those they make at home, which may modify the effect of FAFH. We find that for some nutrients, the adverse effect of FAFH has improved over time. When more recent data become available, an update of this analysis will determine whether these positive changes have continued.

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