



## PAPER

# Fast food restaurant use among adolescents: associations with nutrient intake, food choices and behavioral and psychosocial variables

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**OBJECTIVE:** To examine demographic, behavioral and dietary correlates of frequency of fast food restaurant use in a community-based sample of 4746 adolescent students.

**DESIGN:** A survey was administered to students in classrooms at 31 secondary schools in a large metropolitan area in Minnesota, United States. Height and body weight were measured.

**SUBJECTS:** Students in grades 7–12 who were enrolled in participating schools, had parental consent and were in attendance on the day of data collection.

**MEASUREMENTS:** Frequency of fast food restaurant use (FFFRU), dietary intake, and demographic and behavioral measures were self-reported. Dietary intake was assessed using a semi-quantitative food frequency questionnaire. Height and body weight were directly measured.

**RESULTS:** FFFRU was positively associated with intake of total energy, percent energy from fat, daily servings of soft drinks, cheeseburgers, french fries and pizza, and was inversely associated with daily servings of fruit, vegetables and milk. FFFRU was positively associated with student employment, television viewing, home availability of unhealthy foods, and perceived barriers to healthy eating, and was inversely associated with students' own and perceived maternal and peer concerns about healthy eating. FFFRU was not associated with overweight status.

**CONCLUSIONS:** FFFRU is associated with higher energy and fat intake among adolescents. Interventions to reduce reliance on fast food restaurants may need to address perceived importance of healthy eating as well as time and convenience barriers.

*International Journal of Obesity* (2001) 25, 1823–1833

**Keywords:** fast food; overweight; dietary intake; adolescents

### Introduction

Eating away from home is becoming more common, and fast food restaurant use in particular is growing even more rapidly. In 1970, money spent on away-from-home foods represented 25% of total food spending; by 1995, it comprised 40% of total food spending<sup>1</sup> and by 1999 it reached a record 47.5% of total food spending.<sup>2</sup> It is projected that, by

2010, 53% of the food dollar will be spent away from home.<sup>3</sup> Fast food has been defined as food purchased in self-service or carry-out eating places without waiter service.<sup>3–5</sup> Between 1977 and 1995, the percentage of meals and snacks eaten at fast food restaurants increased 200%, while other restaurant use increased 150%.<sup>3</sup> Fast food outlets are especially popular among adolescents. The average adolescent visits a fast food restaurant twice a week and fast food outlets provide about one-third of the away-from-home meals consumed by adolescents.<sup>6,7</sup>

As away-from-home foods represent an ever-larger proportion of total energy intake, their nutrient profile becomes more important to examine. Away-from-home foods are higher in fat and energy compared with foods eaten at home.<sup>1</sup> In 1995, away-from-home foods accounted for 27% of eating occasions, but 34% of energy intake.<sup>1</sup> At-home

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Received 2 January 2001; revised 10 April 2001;

accepted 16 May 2001

foods comprised 31% fat; by contrast, away-from-home foods comprised 38% fat energy.<sup>1</sup>

High-fat diets contribute to a variety of negative health outcomes, including obesity, hypercholesterolemia, cardiovascular disease and some cancers.<sup>8,9</sup> Most adolescents consume diets that are higher in fat and lower in fruit and vegetables than recommended.<sup>10</sup> It is therefore important to identify factors associated high-fat diets, particularly among adolescents.

The purpose of the present study was to examine cross-sectional associations between fast food restaurant use and nutrient intake, food choices, body weight, and personal, behavioral and environmental variables, in a community-based sample of adolescent students. It was hypothesized that frequent fast food restaurant use (FFFRU) would be associated with a diet that is higher in fat and lower in fruit and vegetables and other healthful nutrients. In addition, the personal, behavioral and lifestyle correlates of fast food restaurant use were examined. This is the first study that we are aware of that examines a broad range of correlates of fast food restaurant use among a large community-based sample of adolescents. A better understanding of the nutritional, behavioral and psychosocial factors associated with fast food restaurant use could help identify whether this widespread sociocultural phenomenon is of concern with respect to adolescent nutrition, and could provide useful descriptive information for potential intervention development.

## Methods

### Subjects and procedures

Data for the present study were collected as part of a larger study, Project EAT (Eating Among Teens). The purpose of Project EAT was to identify the socio-environmental, personal and behavioral factors associated with nutritional intake among a large, ethnically diverse adolescent population. Three school districts in a metropolitan area that served socioeconomically and ethnically diverse communities were identified and invited to participate in the study. Within the three districts, 53 public junior-high and high schools were contacted based on criteria of large size and current nonparticipation in other research studies. Of those, 31 schools agreed to take part in the study. Within schools, all students enrolled in health, physical education or science classes were invited to take part in the study. These classes were chosen in an effort to reach a census of students in each grade served by the school.

Measures were administered to students in classrooms in the 31 schools taking part in the study. Survey and anthropometric data were collected in one 90 min period or two 50 min periods. Trained research staff administered the surveys in school classes and measured height and weight in a private area. Consent procedures were conducted according to the policies of participating school districts. Participation rates varied due to district procedures requiring active or

passive parental consent. Fourteen schools (one district) required active parental consent; 17 schools (two districts) allowed passive parental consent. Average participation rate was 77.1% across all 31 schools. The main reasons for lack of participation were absenteeism and failure to return a consent form in school districts in which active parental consent was required.

Student surveys measured a variety of environmental, personal and behavioral factors associated with dietary intake. Sources of items were diverse, and included items from previously published surveys and items written specifically for the study.<sup>11–15</sup> The student survey was completed by 4746 students; of these, 4413 completed a modified food-frequency questionnaire, and 4344 students were measured for height and weight.

The study sample comprised 50.2% males and 49.8% females. Mean age was 14.9 y (range 11–18 y); 34% were in junior-high school and 65% were in high school. The racial/ethnic self-description of the sample was as follows: 48.5% white, 19.9% black or African-American, 19.2% Asian-American, 5.8% Hispanic, 3.5% native-American or American Indian, and 3.9% mixed/other. Youths who reported more than one response (other than white) were coded as 'mixed/other'. Due to the small number of youths reporting 'Hawaiian or Pacific Islander' ( $n=30$ ), these youths were included in the 'mixed/other' group. Approximately two-thirds of the Asian-American group was Hmong.

### Measures

The following measures were examined in the present report.

**Fast food restaurant use.** Frequency of fast food restaurant (FFFRU) use was measured using the single item. 'In the past week, how often did you eat something from a fast food restaurant (like McDonald's, Burger King, Hardee's etc)?' Response categories ranged from 'Never' to 'five or more times.'

**Nutrients and food choices.** Nutrient and food intake during the past year was measured using the Youth Adolescent Questionnaire (YAQ), a semi-quantitative food frequency questionnaire. It has been quantitatively and qualitatively tested on youths aged 9–18 y.<sup>14,15</sup> The average 1 y reproducibility correlations for 10 nutrients and calories was 0.55 (range 0.24–0.92).<sup>14</sup> Information on nutrients and foods that contribute to nutrients is available.<sup>14,15</sup> For the present report, data were analyzed for total energy intake, percentage of energy from fat, other micronutrients, foods of specific interest (eg fruit, vegetables, milk) and specific foods likely to be consumed at fast food restaurants (eg hamburgers, soft drinks, french fries, pizza).

**Personal variables.** Height and body weight were measured according to a standardized protocol using standardized equipment and trained research assistants. Height was

measured using a portable stadiometer and body weight was measured using a calibrated portable digital scale. Overweight status was based on body mass index (BMI)  $\geq 95$  percentile values for age and gender.<sup>16,17</sup>

Student health concerns were measured with three questions. Students reported their overall health self-description (poor, fair, good, excellent), the extent to which they were concerned about their health (1 = very concerned; 4 = not at all concerned) and the extent to which they cared about being healthy (1 = not at all; 4 = very much). These questions were drawn from previous national studies on adolescent health and development.<sup>13</sup>

Perceived benefits of and barriers to healthy eating were assessed with four measures (all individual questions were four-point Likert scales). A single item assessed the extent to which students cared about eating healthy foods. The perceived benefits of eating healthy foods were measured by summing responses to five questions about the extent to which foods eaten affect health, appearance, weight, sports performance and school performance (Cronbach  $\alpha = 0.83$ ). The perceived taste barriers to healthy eating were assessed by summing four questions about the taste of fruit, vegetables, healthy foods and unhealthy foods (Cronbach  $\alpha = 0.60$ ). The perceived time barriers to healthy eating were assessed by summing three questions about lack of time for healthy eating (Cronbach  $\alpha = 0.71$ ).

Healthy eating self-efficacy was assessed as a summary of nine six-point Likert-scaled questions about self-confidence for eating healthy foods at the mall, after school, with friends, under stress, feeling down, bored, at a fast food restaurant, alone, and at family dinner (not at all sure = 1, to very sure = 6; (Cronbach  $\alpha = 0.83$ ).

Weight concerns and dieting behaviours were assessed with five questions. The extent to which the student cared about weight control, worried about weight gain, and frequency of self-weighing were assessed using four-point Likert-scaled items. Current dieting to lose weight (currently dieting vs not dieting) and self-perception of being overweight (overweight vs normal or underweight) were also measured.

**Behavioral variables.** Physical activity was assessed with four measures. Hours per week and kcals expended per week in physical activity were calculated based on students' responses to three questions about the number of hours per week spent in strenuous, moderate and mild exercise.<sup>18</sup> Strenuous, moderate and mild activity were assigned the MET values of 9, 5 and 3, respectively. Kcal expenditures were calculated as number of hours times the MET value for that activity, summed across the three levels of exercise intensity. Sports participation was assessed with a single question about number of sports teams played on during the past year. Physical inactivity was calculated based on summed responses to questions about number of hours spent in the sedentary activities of television viewing, read-

ing/homework, and computer use. Students reported on these activities separately for weekdays and weekend days.

Television viewing was examined as a separate measure of sedentary behavior. Number of hours watching television and videos on average per weekday and per weekend day were self-reported.

Eating behaviors were assessed with several questions. Frequency of eating out was measured by the sum of the number of times students reported eating breakfast, lunch, dinner or snacks prepared away from home. Frequency of snacking (yesterday) and use of prepared foods such as frozen, canned or microwave dinners (per week) were self-reported.

**Demographic and environmental variables.** Demographic information was self-reported by students and included gender, grade in school, race/ethnicity, education level of parents, receipt of public assistance, and eligibility for free or low-cost school lunch. Home environmental variables included parental employment, student employment, and parental marital status. Parental education, employment, student eligibility for free/reduced lunch and family receipt of public assistance, were combined to create a three-level socioeconomic status (SES) variable. Grade in school was recoded into two groups due to uneven participation rates among grades: 7th and 8th graders ( $n = 1608$ ), and 9th–12th graders ( $n = 3074$ ).

Home availability of foods was measured by summing four questions about the availability of fruit and vegetables and milk at home (Cronbach  $\alpha = 0.63$ ). Home availability of unhealthy foods was measured by summing four questions about the availability at home of 'junk food', potato chips, chocolate or candy, and soft drinks (Cronbach  $\alpha = 0.80$ ). Response options were never, sometimes, usually or always.

Family meals frequency was assessed with the question 'During the past 7 days, how many times did all or most of your family living in your house eat a meal together?' Response options ranged from never to more than seven times.

Perceived parent healthy eating concerns and concerns about their child's healthy eating were measured using a series of four, four-point Likert scales (eg My mother cares about eating healthy food; my father encourages me to eat healthy foods).

Perceived peer health and weight concerns were assessed using two, five-point Likert scale items ('Many of my friends care about healthy eating'; 'Many of my friends diet to lose weight or keep from gaining weight').

### Statistical analysis

All analyses were conducted separately by gender using SAS statistical software package.<sup>19</sup> FFRU was examined in relation to demographic variables, nutrient intake and food choices, and personal, behavioral and environmental variables. Bivariate associations were first examined between

FFFRU and demographic variables. Demographic variables that were significantly associated with fast food restaurant use were included as covariates in separate regression models examining associations between FFFRU and each of the other variables. Continuous dependent variables were examined using SAS PROC MIXED, a mixed-model regression. In these models, FFFRU was a three-level independent variable (never; 1–2 times per week;  $\geq 3$  times per week); fixed covariates were grade (7th and 8th; 9th–12th), gender, race (white vs other), SES (high, middle, low), and BMI; school was included as a random effect. For dichotomous dependent variables, logistic regression models were run in which FFFRU was the independent variable, and school, grade, gender, race, SES and BMI were covariates. In the logistic regression models, FFFRU was coded at a two level variable: 2 or fewer times per week;  $\geq 3$  times per week. Odds ratios and 95% confidence intervals were generated.

Consideration was given to grouping the variables within the personal, behavioral and environmental categories for analysis (eg structural equation modeling or correlated MIXED analyses). However, there was a concern that the variables were heterogeneous within categories and were not really tapping a single construct, and some variables could conceptually fit equally well under the ‘personal’ or the ‘behavioral’ categories. For the descriptive purpose of the present report, the personal, behavioral and environmental categories were used mainly as a conceptual grouping framework. Separate analyses were retained because so little is known about the correlates of fast food use among adolescents, and the individual variables were of interest for descriptive purposes.

In the tables that follow, adjusted means from the mixed model regressions are presented. For associations examined using logistic regression, adjusted percentages are reported in

the tables, and adjusted odds ratios (95% confidence intervals) are reported in the text. Significance values reported on the tables for the dichotomized variables are those from the logistic regression tests of significance. *Post hoc* mean comparisons for significant main effects from the mixed model regressions were adjusted for multiple comparisons using the Bonferroni correction. This approach is conservative for mean comparisons within a single model (dependent variable). However, this does not address the issue of multiple testing across dependent variables. To adjust for multiple testing across dependent variables, only multivariate results significant at the  $P < 0.001$  level or greater are discussed as statistically significant (ie  $P < 0.05/66$  dependent variables =  $P < 0.001$ ).

## Results

### Demographic variables

Unadjusted associations between FFFRU and demographic variables are shown in Table 1. Overall, about 75% of students reported eating at a fast food restaurant during the past week. Females and males significantly differed in their FFFRU ( $P < 0.01$ ). A greater proportion of females (27%) than males (22.8%) reported never visiting a fast food restaurant during the past week. Among both females and males, non-white race was significantly associated with more FFFRU ( $P < 0.01$ ). Compared to 7th and 8th grade males, males in grades 9–12 were more likely to report visiting a fast food restaurant three or more times during the past week (20 vs 25.6%, respectively;  $P < 0.01$ ). Grade in school was not significantly associated with FFFRU among females. SES was significantly associated with FFFRU among females but not among males. A greater proportion of females of low SES

**Table 1** Demographic variables by past week fast food restaurant use among adolescent male and female students

	Fast food restaurant use (past week)					
	Males (n = 2365)			Females (n = 2345)		
	Never	1–2 times	$\geq 3$ times	Never	1–2 times	$\geq 3$ times
n (%) <sup>†</sup>	540 (22.8)	1265 (53.5)	560 (23.7)	634 (27.0)	1192 (50.8)	519 (22.1)
Grade (%)						
7th–8th	27.0	53.0	20.0*	26.5	52.2	21.3
9th–12th	20.7	53.7	25.6	27.3	50.4	22.3
Race (%)						
non-white	22.7	50.9	26.4*	25.3	48.7	26.0*
white	23.0	55.8	21.2	29.1	53.7	17.2
SES (%)						
low	22.8	54.0	23.2	26.1	49.1	24.8*
middle	21.4	54.6	24.0	25.6	51.6	22.8
high	23.9	52.5	23.7	29.3	53.2	17.5
Free or reduced lunch (qualify %)						
yes	25.3	52.4	22.3	26.9	50.0	23.1
no	22.0	55.4	22.6	26.8	54.2	19.0

Note: unadjusted *P*-values from chi-square test of within-gender demographic variable  $\times$  fast food frequency (2  $\times$  3 or 3  $\times$  3) test. \* $P < 0.01$  within gender. <sup>†</sup> $P < 0.01$  for gender difference.

reported visiting a fast food restaurant three or more times during the past week compared with females of high SES (24.8 vs 17.5%, respectively;  $P < 0.0001$ ). Eligibility for free or reduced lunch was not significantly associated with FFFRU among either males or females.

**Nutrients and food choices**

Associations between fast food restaurant use and selected nutrients are shown in Table 2. Among both males and females, FFFRU was significantly positively associated with total energy, percentage energy from fat, total fat and saturated fat (all  $P < 0.001$ ). A dose-response pattern was observed such that energy and percentage fat energy significantly increased between each of the frequency categories of fast food restaurant use. Among females, a significant dose-response pattern of positive association was observed for total fat and saturated fat, and inverse associations were observed for calcium, fiber, vitamin A, vitamin C and carotene.

Among males, significant associations between FFFRU and nutrients were largely attributable to males who reported three or more fast food restaurant visits during the past week. Males who reported three or more visits reported significantly higher total and saturated fat and caffeine intake, and significantly lower calcium, vitamin A, vitamin C and caro-

tene intake, compared with males who reported two or fewer fast food restaurant visits during the past week. Associations between FFFRU and sodium were not significant among males or females.

Associations between FFFRU and food choices are shown in Table 3. Overall, among both females and males, significant positive associations were observed between FFFRU and high-fat, high-sugar food choices such as soft drinks, french fries and cheeseburgers. Significant inverse associations were observed with healthful food choices such as fruit, vegetables, grains and milk. Compared with females who reported never eating at a fast food restaurant during the past week, females who reported eating at a fast food restaurant three or more times during the past week reported 45% greater soft drink consumption, 100% greater cheeseburger consumption and 60% greater french fries consumption; 23% less fruit consumption, 29% less vegetable consumption (excluding french fries) and 21% less milk consumption. Compared with males who reported never eating at a fast food restaurant during the past week, males who reported eating at a fast food restaurant three or more times during the past week reported 42% greater soft drink consumption, 73% greater cheeseburger consumption, and 53% greater french fries consumption; 27% less fruit consumption, 32% less vegetable consumption (excluding french fries), and 22% less milk consumption.

**Table 2** Nutrient intake associated with past week fast food restaurant use among adolescent male and female students

Nutrients	Fast food restaurant use (past week)					
	Males (n = 2365)			Females (n = 2345)		
	Never	1–2 times	≥ 3 times	Never	1–2 times	≥ 3 times
Energy (kcal)	1952.6 (71.8) <sup>A</sup>	2192.5 (60.2) <sup>B</sup>	2753.8 (71.4) <sup>C*</sup>	1801.0 (54.1) <sup>A</sup>	2005.0 (45.1) <sup>B</sup>	2461.1 (59.2) <sup>C*</sup>
Fat energy (%)	29.3 (0.2) <sup>A</sup>	30.3 (0.2) <sup>B</sup>	31.8 (0.2) <sup>C*</sup>	27.8 (0.3) <sup>A</sup>	29.8 (0.2) <sup>B</sup>	31.2 (0.3) <sup>C*</sup>
Total fat (g)	75.5 (0.6)	77.1 (0.4)	81.3 (0.6) <sup>A*</sup>	63.7 (0.6) <sup>A</sup>	67.2 (0.4) <sup>B</sup>	71.5 (0.61) <sup>C*</sup>
Saturated fat (g)	26.7 (0.3)	27.4 (0.2)	28.8 (0.3) <sup>A*</sup>	22.4 (0.3) <sup>A</sup>	23.8 (0.2) <sup>B</sup>	25.4 (0.3) <sup>C*</sup>
Fiber (g)	26.3 (2.2)	24.7 (2.1)	23.5 (2.2) <sup>NS</sup>	26.8 (2.1) <sup>A</sup>	24.3 (2.0) <sup>B</sup>	22.3 (2.1) <sup>C*</sup>
Calcium (mg)	1270.7 (22.0)	1243.8 (16.4)	1115.1 (22.0) <sup>A*</sup>	1090.5 (19.6)	1051.1 (15.9)	966.6 (21.9) <sup>A*</sup>
Vitamin A (IU)	9673.1 (248.4)	9121.6 (166.0)	7626.5 (248.8) <sup>A*</sup>	10202.4 (271.5) <sup>A</sup>	9149.4 (214.1) <sup>B</sup>	7236.9 (306.8) <sup>C*</sup>
Vitamin C (mg)	169.7 (4.2)	159.6 (3.1)	141.7 (4.2) <sup>A*</sup>	164.3 (3.4)	156.1 (2.5)	139.7 (4.0) <sup>A*</sup>
Carotene (IU)	6477.2 (241.3)	5851.4 (167.8)	4801.7 (241.7) <sup>A*</sup>	7319.9 (261.7) <sup>A</sup>	6259.6 (209.7) <sup>B</sup>	4805.0 (293.8) <sup>C*</sup>
Caffeine (mg)	44.1 (2.5)	47.9 (2.0)	54.9 (2.6) <sup>A*</sup>	39.9 (1.8)	41.8 (1.3)	48.9 (2.1) <sup>NS</sup>
Sodium (mg)	2690.5 (24.2)	2666.2 (18.7)	2635.0 (24.3) <sup>NS</sup>	2339.9 (21.7)	2356.1 (17.7)	2306.9 (24.1) <sup>NS</sup>

Note: least squares means and standard errors adjusted for grade, race, school, socioeconomic status, and body mass index. Nutrients also adjusted for total energy intake (except for variables total energy and percent fat energy). \* $P < 0.001$  for omnibus  $F$ -test for fast food frequency. Different superscripts indicate significantly different means by *post-hoc* comparison ( $P < 0.05$ ). NS = not significant.

**Table 3** Food choices associated with past week fast food restaurant use among adolescent male and female students

Food choices (servings per day)	Fast food restaurant use (past week)					
	Males (n = 2365)			Females (n = 2345)		
	Never	1–2 times	≥ 3 times	Never	1–2 times	≥ 3 times
Fruit	2.6 (0.09) <sup>A</sup>	2.3 (0.06) <sup>B</sup>	2.0 (0.08) <sup>C*</sup>	2.6 (0.08) <sup>A</sup>	2.4 (0.07) <sup>B</sup>	1.9 (0.09) <sup>C*</sup>
Vegetables	2.1 (0.06) <sup>A</sup>	1.9 (0.05) <sup>B</sup>	1.6 (0.06) <sup>C*</sup>	2.3 (0.06) <sup>A</sup>	1.9 (0.05) <sup>B</sup>	1.7 (0.07) <sup>C*</sup>
Vegetables excluding french fries	1.9 (0.07) <sup>A</sup>	1.7 (0.05) <sup>B</sup>	1.4 (0.07) <sup>C*</sup>	2.1 (0.06) <sup>A</sup>	1.8 (0.05) <sup>B</sup>	1.5 (0.07) <sup>C*</sup>
Dark vegetables	0.6 (0.03) <sup>A</sup>	0.5 (0.02) <sup>B</sup>	0.4 (0.03) <sup>C*</sup>	0.7 (0.03) <sup>A</sup>	0.6 (0.03) <sup>B</sup>	0.4 (0.04) <sup>C*</sup>
Grains	6.6 (0.10)	6.4 (0.07)	6.1 (0.10) <sup>A*</sup>	5.8 (0.09)	5.7 (0.08)	5.3 (0.10) <sup>A*</sup>
Calcium-rich foods	3.7 (0.08)	3.6 (0.06)	3.3 (0.08) <sup>A*</sup>	3.1 (0.07)	3.0 (0.06)	2.8 (0.08) <sup>NS</sup>
Milk	1.8 (0.07)	1.7 (0.05)	1.3 (0.07) <sup>A*</sup>	1.4 (0.06)	1.3 (0.05)	1.1 (0.07) <sup>A*</sup>
French fries	0.14 (0.01) <sup>A</sup>	0.18 (0.01) <sup>B</sup>	0.22 (0.01) <sup>C*</sup>	0.13 (0.01)	0.15 (0.01)	0.23 (0.01) <sup>A*</sup>
Hamburgers	0.12 (0.01)	0.11 (0.01) <sup>A*</sup>	0.14 (0.01) <sup>A*</sup>	0.07 (0.01)	0.07 (0.004)	0.09 (0.01) <sup>A*</sup>
Cheeseburgers	0.11 (0.01) <sup>A</sup>	0.13 (0.01) <sup>B</sup>	0.19 (0.01) <sup>C*</sup>	0.07 (0.01) <sup>A</sup>	0.09 (0.01) <sup>B</sup>	0.14 (0.01) <sup>C*</sup>
Pizza	0.14 (0.01) <sup>A</sup>	0.18 (0.01) <sup>B</sup>	0.21 (0.01) <sup>C*</sup>	0.12 (0.01)	0.13 (0.004)	0.17 (0.01) <sup>A*</sup>
Tacos	0.09 (0.01)	0.10 (0.004)	0.15 (0.01) <sup>A*</sup>	0.07 (0.01)	0.09 (0.004)	0.14 (0.01) <sup>A*</sup>
Milkshakes	0.05 (0.003)	0.05 (0.002)	0.07 (0.003) <sup>A*</sup>	0.04 (0.002)	0.05 (0.001)	0.06 (0.003) <sup>A*</sup>
Soft drinks (non-diet)	1.2 (0.05) <sup>A</sup>	1.4 (0.04) <sup>B</sup>	1.6 (0.05) <sup>C*</sup>	1.1 (0.05) <sup>A</sup>	1.3 (0.04) <sup>B</sup>	1.6 (0.06) <sup>C*</sup>

Note: least squares means and standard errors are adjusted for grade, race, school, socioeconomic status, body mass index, and total energy. \* $P < 0.001$  for omnibus  $F$ -test for fast food frequency. Different superscripts indicate significantly different means by *post-hoc* comparison ( $P < 0.05$ ). NS = not significant.

### Personal and behavioral variables

Associations between fast food restaurant use and personal factors are shown in Table 4. Associations between personal variables and FFRU were similar among females and males. Overweight status was not significantly associated with FFRU among males or females. Interestingly, BMI was significantly lower among males who reported using fast food restaurants three or more times per week, compared with those reporting less frequent fast food restaurant use. BMI was not significantly associated with FFRU among females. Perceived barriers for healthy eating were consistently associated with FFRU and patterns were very similar among females and males. Compared with less frequent users, females and males who reported three or more visits to fast food restaurants in the past week were significantly more likely to report that healthy foods tasted bad, that they lack the time to eat healthy foods, and that they cared little about healthy eating (all  $P < 0.001$ ). Among females, perceived benefits of healthy eating were significantly lower among those visiting fast food restaurants three or more times per week, compared with those visiting fast food restaurants two or fewer times per week. Among males and females, healthy eating self-efficacy did not significantly differ by FFRU.

Health perceptions were inversely associated with FFRU. Females who perceived themselves to be in good or excellent health were less likely to have visited a fast food restaurant during the past week (females' odds ratio (OR) = 0.63; 95% confidence interval (CI) 0.50, 0.80;  $P < 0.0002$ ). A similar pattern of association was observed among males, however it was not statistically significant by our conservative criteria ( $P < 0.001$ ; males' OR = 0.74; 95% CI 0.56, 0.98;  $P < 0.03$ ).

Both females and males who reported three or more fast food restaurant visits during the past week reported caring about their health less than those who ate at fast food restaurants less frequently ( $P < 0.001$ ). Interestingly, FFRU did not distinguish females or males in terms of weight perceptions, concern about weight gain, self-weighing behavior or current dieting.

Associations between FFRU and behavioral factors are also shown in Table 4. Physical activity hours and kcals per week, and hours of inactivity, were not significantly associated with FFRU. However, number of team sports played during the past year was significantly positively associated with FFRU among males only ( $P < 0.001$ ). Males who reported never eating at a fast food restaurant during the past week reported participating in significantly fewer team sports during the past year compared to males who reported eating one or more times during the past week at a fast food restaurant. Weekday television viewing was significantly positively associated with FFRU among females and males ( $P < 0.001$ ). Weekend television viewing was also significantly positively associated with FFRU but only among females ( $P < 0.001$ ). Females who reported never eating at a fast food restaurant during the past week watched significantly fewer hours of television on weekends compared with females who reported eating at a fast food restaurant one or more times during the past week. Among females and males, frequency of eating out, number of snacks yesterday, and eating ready-made foods were significantly positively associated with FFRU (all  $P < 0.001$ ). The overall pattern of association was dose-response, with increasing eating out, snacking and eating ready-made foods associated with more frequent fast food restaurant use during the past week.

**Table 4** Personal and behavioral variables associated with past week fast food restaurant use among adolescent male and female students

Personal variables	Fast food restaurant use (past week)					
	Males (n = 2365)			Females (n = 2345)		
	Never	1–2 times	≥ 3 times	Never	1–2 times	≥ 3 times
Body mass index (kg/m <sup>2</sup> ) <sup>SS</sup>	23.5 (0.25)	23.2 (0.18)	22.4 (0.24) <sup>A*</sup>	23.5 (0.28)	23.5 (0.24)	23.2 (0.30) <sup>NS</sup>
Overweight (%; above 95 percentile) <sup>SSa</sup>	19.4 (0.02)	17.1 (0.01)	12.4 (0.02) <sup>NS</sup>	14.6 (0.02)	14.2 (0.01)	12.7 (0.02) <sup>NS</sup>
Perceived benefits/barriers to healthy eating						
Perceived benefits of healthy eating <sup>b</sup>	14.7 (0.17)	14.6 (0.11)	14.3 (0.16) <sup>NS</sup>	15.6 (0.15) <sup>A</sup>	15.2 (0.12) <sup>AB</sup>	14.8 (0.17) <sup>B*</sup>
Perceived bad taste <sup>b</sup>	8.2 (0.11) <sup>A</sup>	8.8 (0.07) <sup>B</sup>	9.2 (0.10) <sup>C*</sup>	7.5 (0.11) <sup>A</sup>	8.2 (0.09) <sup>B</sup>	8.7 (0.12) <sup>C*</sup>
Lack of time to eat healthy <sup>b</sup>	5.4 (0.09) <sup>A</sup>	5.7 (0.05) <sup>B</sup>	6.2 (0.09) <sup>C*</sup>	5.4 (0.08) <sup>A</sup>	5.6 (0.06) <sup>B</sup>	6.1 (0.09) <sup>C*</sup>
Care about eating healthy food (1 = not at all; 4 = very much)	3.1 (0.04)	3.0 (0.03)	2.8 (0.04) <sup>A*</sup>	3.3 (0.03) <sup>A</sup>	3.1 (0.02) <sup>B</sup>	3.0 (0.04) <sup>C*</sup>
Healthy eating self-efficacy <sup>b</sup>	32.0 (0.46)	31.4 (0.29)	30.2 (0.44) <sup>NS</sup>	31.5 (0.43)	30.8 (0.33)	29.9 (0.48) <sup>NS</sup>
Health concerns						
Health self-description <sup>a</sup> (% good or excellent)	81.0 (0.02)	80.3 (0.01)	76.2 (0.02) <sup>NS</sup>	69.8 (0.02)	71.7 (0.02)	61.6 (0.02) <sup>A*</sup>
Health concern (1 = concerned; 4 = not concerned)	1.9 (0.04)	2.0 (0.02)	2.1 (0.04) <sup>A*</sup>	1.7 (0.03)	1.8 (0.02)	1.9 (0.04) <sup>A*</sup>
Care about health (1 = not at all; 4 = very much)	3.5 (0.04)	3.5 (0.03)	3.3 (0.04) <sup>A*</sup>	3.6 (0.03)	3.5 (0.02)	3.3 (0.04) <sup>A*</sup>
Weight concerns and dieting behaviors						
Weight self-perception <sup>a</sup> (% perceive self as overweight)	22.5 (0.02)	22.2 (0.01)	21.1 (0.02) <sup>NS</sup>	42.0 (0.02)	39.9 (0.02)	44.2 (0.02) <sup>NS</sup>
Care about weight control (1 = not at all; 4 = very much)	2.9 (0.06)	2.8 (0.05)	2.7 (0.06) <sup>NS</sup>	3.3 (0.05)	3.2 (0.04)	3.1 (0.05) <sup>NS</sup>
Worry about weight gain (1 = disagree; 4 = agree)	2.2 (0.04)	2.2 (0.03)	2.1 (0.04) <sup>NS</sup>	2.9 (0.05)	2.8 (0.04)	2.8 (0.05) <sup>NS</sup>
Weigh myself often (1 = disagree; 4 = agree)	2.0 (0.04)	2.1 (0.03)	2.1 (0.04) <sup>NS</sup>	2.2 (0.04)	2.2 (0.03)	2.3 (0.05) <sup>NS</sup>
Currently dieting (%) <sup>a</sup>	21.2 (0.02)	19.6 (0.01)	18.7 (0.02) <sup>NS</sup>	43.0 (0.02)	41.4 (0.02)	40.0 (0.03) <sup>NS</sup>
Behavioral variables						
Physical activity						
Hours per week	10.4 (0.31)	11.1 (0.20)	10.8 (0.30) <sup>NS</sup>	8.4 (0.27)	8.6 (0.21)	8.6 (0.31) <sup>NS</sup>
kcal/kg/week	61.7 (1.9)	66.2 (1.2)	64.0 (1.8) <sup>NS</sup>	47.4 (1.6)	47.9 (1.3)	47.3 (1.8) <sup>NS</sup>
Inactive (h/week)	44.6 (1.4)	44.2 (1.1)	45.2 (1.4) <sup>NS</sup>	42.1 (1.0)	44.3 (0.82)	45.1 (1.2) <sup>NS</sup>
Team sports (no./past year)	1.2 (0.06) <sup>A</sup>	1.5 (0.04)	1.5 (0.06) <sup>*</sup>	1.0 (0.06)	1.1 (0.05)	1.0 (0.06) <sup>NS</sup>
Television viewing						
Weekday (h)	4.5 (0.08) <sup>A</sup>	4.7 (0.06) <sup>B</sup>	5.0 (0.08) <sup>C*</sup>	4.1 (0.08) <sup>A</sup>	4.5 (0.06) <sup>B</sup>	4.8 (0.09) <sup>C*</sup>
Weekend (h)	4.6 (0.09)	4.7 (0.06)	4.8 (0.09) <sup>NS</sup>	4.1 (0.08) <sup>A</sup>	4.5 (0.06)	4.6 (0.09) <sup>*</sup>
Eating behaviors						
Eating out (no. times/past week)	10.5 (0.20) <sup>A</sup>	11.0 (0.15) <sup>B</sup>	12.5 (0.20) <sup>C*</sup>	10.1 (0.20) <sup>A</sup>	10.8 (0.17) <sup>B</sup>	12.4 (0.22) <sup>C*</sup>
Snacks (no./yesterday)	2.5 (0.06) <sup>A</sup>	2.8 (0.04) <sup>B</sup>	3.1 (0.06) <sup>C*</sup>	2.5 (0.06) <sup>A</sup>	2.6 (0.05) <sup>B</sup>	3.1 (0.06) <sup>C*</sup>
Eat ready-made foods (1 = never; 4 = 5+ times/week)	1.6 (0.05) <sup>A</sup>	1.8 (0.04) <sup>B</sup>	2.0 (0.05) <sup>C*</sup>	1.6 (0.05) <sup>A</sup>	1.8 (0.04) <sup>B</sup>	2.0 (0.06) <sup>C*</sup>

Note: least squares means and standard errors adjusted for grade, race, school, socioeconomic status and body mass index. \* $P < 0.001$  for omnibus  $F$ -test for fast food frequency. Different superscripts indicate significantly different means by *post-hoc* comparison (\* $P < 0.05$ ). NS = not significant.

<sup>SS</sup>Not adjusted for body mass index.

<sup>a</sup>Unadjusted percentage;  $P$ -value is from multivariate logistic regression.

<sup>b</sup>Multi-item summary scores.

**Environmental variables**

Associations between FFRU and environmental factors are shown in Table 5. Among females and males, FFRU was not associated with parental employment status, but was positively associated with a student's likelihood of working for pay 10 h or more per week (females' OR = 2.36; 95% CI 1.82, 3.06;  $P < 0.0001$ ; males' OR = 2.14; 95% CI 1.69, 2.71;  $P < 0.0001$ ). Females and males who worked for pay 10 h or more per week were twice as likely to frequent fast food restaurants three or more times per week compared to those who worked less than 10 h per week. Among females only, FFRU was associated with a lower likelihood of parents being married (OR = 0.60; 95% CI 0.48, 0.76;  $P < 0.0001$ ). Among both females and males, FFRU was significantly associated with availability of unhealthy foods in the home environment ( $P < 0.0001$ ). Family meal frequency and availability of healthy foods at home were not significantly associated with FFRU. Overall, perceived parental concerns

with healthy eating were not significantly associated with frequency of fast food restaurant use among females or males. One exception was that females who reported visiting a fast food restaurant three or more times per week reported significantly lower mother's concern with her own healthy eating, compared with females who reported two or fewer fast food restaurant visits per week. Compared to those who reported fewer fast food restaurant visits during the past week, both females and males who reported three or more fast food restaurant visits during the past week also reported significantly lower mother's concern about their child's healthy eating ( $P < 0.001$ ). Among both males and females, frequent fast food restaurant users (three or more times during the past week) reported less friends' concern with healthy eating compared with less frequent fast food restaurant users ( $P < 0.001$ ). Among both females and males, friends' concerns with weight control were not significantly associated with FFRU.

**Table 5** Environmental variables associated with past week fast food restaurant use among adolescent male and female students

Environmental variables	Fast food restaurant use (past week)					
	Males (n = 2365)			Females (n = 2345)		
	Never	1 – 2 times	≥ 3 times	Never	1 – 2 times	≥ 3 times
<b>Employment</b>						
Mother full time (%) <sup>a</sup>	70.0 (0.03)	69.1 (0.02)	68.2 (0.03) <sup>NS</sup>	68.5 (0.03)	68.7 (0.02)	65.7 (0.03) <sup>NS,5</sup>
Father full time (%) <sup>a</sup>	86.5 (0.02)	89.3 (0.01)	86.1 (0.02) <sup>NS</sup>	84.6 (0.02)	85.5 (0.02)	84.0 (0.02) <sup>NS</sup>
Student > 10 h/week (%) <sup>a</sup>	21.2 (0.02)	25.2 (0.01)	38.9 (0.02) <sup>A*</sup>	15.8 (0.02) <sup>A</sup>	21.6 (0.02) <sup>B</sup>	34.5 (0.02) <sup>C*</sup>
<b>Parents' marital status</b>						
Married (%) <sup>a</sup>	64.3 (0.03)	60.1 (0.02)	59.0 (0.03) <sup>NS</sup>	62.8 (0.03)	60.5 (0.03)	51.0 (0.03) <sup>A*</sup>
<b>Home availability of foods</b>						
Healthy foods <sup>b</sup>	12.5 (0.11)	12.5 (0.07)	12.3 (0.11) <sup>NS</sup>	12.4 (0.11)	12.3 (0.08)	12.3 (0.12) <sup>NS</sup>
Unhealthy foods <sup>b</sup>	10.0 (0.14) <sup>A</sup>	10.9 (0.11) <sup>B</sup>	11.7 (0.14) <sup>C*</sup>	9.9 (0.15) <sup>A</sup>	10.9 (0.13) <sup>B</sup>	12.0 (0.16) <sup>C*</sup>
Family eats meal together (1 = never, 6 = > 7 times/week)	2.8 (0.04)	2.8 (0.03)	2.7 (0.04) <sup>NS</sup>	2.8 (0.05)	2.8 (0.04)	2.6 (0.05) <sup>NS</sup>
<b>Perceived parent concerns about healthy eating</b>						
Mother concern with own healthy eating (1 = not at all; 4 = very much)	3.2 (0.04)	3.2 (0.03)	3.1 (0.04) <sup>NS</sup>	3.2 (0.04)	3.2 (0.03)	3.0 (0.05) <sup>A*</sup>
Mother concern with child healthy eating (1 = not at all; 4 = very much)	3.1 (0.05)	3.1 (0.03)	2.9 (0.04) <sup>A*</sup>	3.2 (0.05)	3.1 (0.04)	2.9 (0.05) <sup>A*</sup>
Father concern with own healthy eating (1 = not at all; 4 = very much)	2.8 (0.05)	2.8 (0.03)	2.6 (0.05) <sup>NS</sup>	2.8 (0.06)	2.7 (0.04)	2.6 (0.06) <sup>NS</sup>
Father concern with child healthy eating (1 = not at all; 4 = very much)	2.7 (0.05)	2.7 (0.03)	2.6 (0.05) <sup>NS</sup>	2.7 (0.06)	2.7 (0.04)	2.6 (0.06) <sup>NS</sup>
<b>Perceived peer health and weight concern</b>						
Friends care about healthy eating (1 = not at all; 4 = very much)	2.9 (0.06)	2.8 (0.04)	2.5 (0.06) <sup>A*</sup>	3.2 (0.05)	3.1 (0.04)	2.8 (0.06) <sup>A*</sup>
Friends care about weight control (1 = not at all; 4 = very much)	2.4 (0.07)	2.4 (0.05)	2.2 (0.07) <sup>NS</sup>	2.7 (0.06)	2.7 (0.05)	2.8 (0.07) <sup>NS</sup>

Note: <sup>a</sup>Unadjusted percentage;  $P$ -value is from multivariate logistic regression.

## Discussion

The purpose of the present research was to describe the nutrient intake, food choices, personal, behavioral and environmental variables associated with FFRU among adolescents. The most striking findings were the strong associations observed between FFRU and nutritional intake. Compared to those who reported never eating at a fast food restaurant during the past week, total energy intake was 40% higher among males and 37% higher among females, and percentage energy from fat was 9% higher among males and 13% higher among females who reported three or more visits to a fast food restaurant during the past week. FFRU was associated with significantly lower intake of fruit, vegetables, grains and servings of milk, and with significantly higher intake of soft drinks, cheeseburgers, pizza and french fries. These results suggest that the dietary intakes of adolescents who frequently consume fast food are of poorer nutritional quality compared to those who are less frequent consumers of fast food, and are consistent with national dietary surveillance data that show that away-from-home foods are higher in fat compared to foods consumed from home (38% fat vs 31% fat, respectively).<sup>1,6,7</sup> While some fast food restaurants do offer lower fat options, most fast food consumed by adolescents is higher in fat and saturated fat compared to foods consumed from other sources.<sup>1,6,7,22</sup> Studies among adults have found positive cross-sectional and prospective associations between frequency of fast food restaurant use and energy and fat intake.<sup>20,21</sup> We are not aware of any studies that examined associations between fast food intake and dietary quality among adolescents.

In addition to concerns about higher fat and total energy intake, FFRU is of concern because of its association with lower calcium intake and higher soft drink consumption. FFRU may encourage soft drink consumption, and displace consumption of calcium-rich foods, including milk. This may contribute to lower calcium intake and lower bone mineral density gains among adolescents.<sup>23,24</sup> Low bone mineral density gains in adolescence may increase risk of osteoporosis later in life.<sup>25-27</sup> Clearly, the findings with respect to higher fat and energy intake, and lower calcium intake, among frequent fast food restaurant users is an important concern with respect to its effects on the nutritional health of adolescents.<sup>8,9</sup>

In the present study, no association was observed between FFRU and obesity, even though fast food restaurant use was significantly positively associated with energy and fat intake. BMI was not associated with FFRU in females. In males, BMI was significantly inversely associated with FFRU. Males who visited fast food restaurants three or more times per week had significantly lower BMI compared with males who visited fast food restaurants two or fewer times per week. This finding is intriguing and warrants further study. The lack of association among females and the inverse association among males could be due to the fact that adolescents are experiencing growth and currently have high energy

needs. It could be that the frequent use of fast food restaurants and consequent higher fat and energy intake places adolescents at risk for future weight gain during young adulthood when energy needs are reduced.<sup>28</sup> While the present study reports only cross-sectional associations, it is plausible that a prospective study design would detect significant associations between fast food restaurant use and weight gain or obesity. In one study of 891 young adult women, increases over a 3 y period in the frequency of fast food restaurant use were associated with an excess weight gain of 0.72 kg (1.6 lb) over and above the average weight gain during this observation period.<sup>20</sup> To the best of our knowledge, no data are available on the association between fast food restaurant use and weight gain or the development of overweight among children and adolescents. However, additional prospective studies are clearly needed and would be of great value in understanding the potential contribution of fast food restaurant use to excess weight gain or the development of obesity during young adulthood.

Environmental variables such as lifestyle and family structure provide clues regarding adolescents who may be at risk for more FFRU. Female adolescents in single-parent families were more likely to report FFRU. Since about 27% of all households with children in 1998 were single-parent households, this represents a potentially important demographic segment that is consuming fast food on a regular basis.<sup>25</sup> Thus, the increasing popularity of fast food may be due in part to the fact that more women are in the workforce, a greater proportion of households with children are single-parent households, and less time is available for food preparation activities.<sup>29,30</sup> Adolescents who work for pay 10 h or more per week were also more likely to be FFRUs. Since many fast food restaurants employ adolescents, these work-sites may influence their dietary intake through increased availability, employee discounts, and free meals and beverages.<sup>22,31,32</sup> These associations suggest that fast food restaurants offer a quick and convenient means of obtaining meals for families or adolescents who have little time for meal preparation.

Television viewing has been cited as a contributing factor to higher energy or fat intake.<sup>33,34</sup> Exposure to food advertising, especially fast food commercials, may influence viewers' food choices toward higher fat, higher energy foods.<sup>34-39</sup> Television viewing may also contribute to higher energy or fat intake due to snacking in front of the television.<sup>34,41</sup> In the present study, television viewing was positively associated with FFRU among both females and males. It is unclear whether exposure to television advertising for fast foods increases consumption specifically of fast food or consumption of higher fat foods more broadly.<sup>34-40,42</sup> Given its pervasiveness in the lives of youth, television would seem to be an important environmental exposure that could promote greater fast food consumption among adolescents. Additional research is needed to examine the relationship between television viewing and food choices among adolescents, particularly focusing on heavily

advertised foods such as fast foods, high-fat snack foods and soft drinks.

Personal variables associated with greater fast food restaurant use among both females and males included less concern about healthy eating, more perceived barriers to healthy eating (eg poor taste of healthier foods, lack of time to eat healthy foods), and lower perceptions of maternal concern for their child's healthy eating. Perceived benefits among males, and self-efficacy for healthy eating among males and females, were not associated with FFFRU. These findings are consistent with the literature on the correlates of adolescent food choices.<sup>23</sup> Time and convenience are important reported influences on adolescent food choices.<sup>22</sup> Although health concerns are overall not an important motivator of food choices among adolescents, food choices are healthier among those adolescents who are motivated by concern about their health.<sup>22</sup> Interestingly, dieting behaviors and weight concerns were not associated with FFFRU. This finding is consistent with the literature on adolescent dieting, which shows both healthy and unhealthy food choices and nutritional intake among dieters.<sup>22</sup>

Among males, team sports participation was associated with FFFRU. This active subset of males may have less time for family meals at home, and therefore rely on fast food restaurants for quick meals. FFFRU who are also highly physically active may expend enough energy to compensate for the high levels of energy and fat present in fast foods. However, their overall dietary quality is still poor in comparison with adolescents who rely less on fast foods. A further concern is that eating habits established in adolescence, including preference for and reliance on fast food, may place them at future risk for higher fat and energy intake as they move into young adulthood, a developmental period that is high risk for increased sedentary behaviors and excess weight gain.<sup>43</sup>

The present study had several strengths, including its ethnically and socioeconomically diverse sample and comprehensive and diverse behavioral and psychosocial measures. The inclusion of a validated, comprehensive measure of dietary intake, and measured body weight and height, were also significant strengths. Limitations included the reliance on a single-item measure of fast food intake, the lack of measures of food choices at fast food restaurants, and a mismatch between the time frame covered by the food frequency dietary assessment (past year) and the fast food measure (past week). Fast food restaurant use was assessed during the time period of the past 7 days. It is not known whether the past 7 days were representative of students' typical FFFRU. Although fast food restaurant use was associated with overall poorer nutritional quality and food choices, it is not clear whether this was attributable specifically to the foods from the fast food restaurants or to poorer food choices at other times.

In conclusion, FFFRU is associated with a less nutritious diet and poorer food choices among adolescents. Structural variables such as parent and adolescent work commitments

may promote greater reliance on fast food restaurants. Interventions to reduce FFFRU or to improve the specific food selections made from fast food restaurants may need to address the perceived convenience and importance of healthy eating among both adolescents and their parents. Strategies are needed to ensure that food choices made on eating occasions other than at fast food restaurants are comprised of healthier foods that are high in nutrient density (eg higher in fruit and vegetables, lower in fat and energy). If fast food restaurants are utilized, more healthful food choices at such establishments could be promoted by policies requiring nutrition labeling on fast food packages, restrictions on portion sizes of higher fat food choices, or pricing structures that encourage more healthful food choices.<sup>40,42,44</sup> Additional research is needed to better understand the short- and longer-term nutrition and health consequences of FFFRU among adolescents.

### Acknowledgements

This study was supported by grant MCJ-270834 (D Neumark-Sztainer, PhD, Principal Investigator) from the Maternal and Child Health Bureau (Title V, Social Security Act), Health Resources and Service Administration, US Department of Health and Human Services.

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