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Campus food and beverage purchases are associated with indicators of diet quality in college students

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Abstract

Purpose—To examine the association between college students' overall dietary patterns and their frequency of purchasing food and beverages from campus area venues, purchasing fast food, and bringing food from home.

Design—Cross-sectional Student Health and Wellness Study.

Setting—One community college and one public university in the Twin Cities, MN.

Subjects—Diverse college students living off campus (n=1,059, 59% nonwhite, mean (SD) age 22 (5) years).

Measures—Participants self-reported socio-demographic characteristics and frequency of purchasing food/beverages around campus, purchasing fast food, and bringing food from home. Campus area purchases included those from à la carte facilities, vending machines, beverages, and nearby restaurants/stores. Dietary outcome measures included breakfast and evening meal consumption frequency (days/week) and summary variables of fruit and vegetable, dairy, calcium, fiber, added sugar, and fat intake calculated from food frequency screeners.

Analysis—T-tests and linear regression examined the association between each purchasing behavior and dietary outcomes.

Results—Approximately 45 percent of students purchased food/beverages from at least one campus area venue 3 times/week. Frequent food/beverage purchasing around campus was associated with less frequent breakfast consumption and higher fat and added sugar intake, similar to fast food purchasing. Bringing food from home was associated with healthier dietary patterns.

Conclusion—Increasing the healthfulness of campus food environments and promoting healthy food and beverage purchasing on and around campuses may be an important target for nutrition promotion among college students.

Keywords

food environment; nutrition; young adults; colleges and universities; fast food

Purpose

Food environments can have an important influence on when, where, and how much people eat.¹ Nearly half of U.S. high school graduates under age 25 are enrolled in post-secondary

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institutions,² yet little is known about how post-secondary campus food environments may influence young adults' dietary intake. This study sought to examine the association between college students' dietary patterns and their purchases of food and beverages from campus area venues and fast food restaurants, as well as frequency of bringing food from home. While primary and secondary school food environments are consistently targeted for nutrition promotion efforts,³⁻⁵ post-secondary food environments may present an overlooked opportunity to promote healthy diets during a critical transition in weight-related health behaviors.⁶

Young adults exhibit some of the poorest dietary habits of all age groups, including frequent fast food consumption^{7,8} and low rates of adherence to national dietary guidelines.^{6,9} Previous research suggests that campus food environments may influence young adults' dietary decisions, though the evidence is mixed on whether that influence is positive or negative. Some studies have found higher intake of fruits and vegetables¹⁰⁻¹³ and dairy¹¹ among students living or eating on campus. In contrast, Freedman¹⁴ found that first-year students who moved to campus reduced their meal frequency and intake of fruits, vegetables and dairy. Brown et al.¹² found students living on campus had higher meat intake than those living off campus, while Brevard and Ricketts¹⁵ found students living on campus consumed less protein than those living off campus.

A limitation of these studies is that with only one exception¹¹ on-campus residence was used as a proxy for exposure to the campus food environment, with students living off campus considered "unexposed." While full-service dining halls are often cited as a contributor to freshman weight gain,¹⁶ other aspects of the campus food environment, including vending machines, à la carte dining facilities, and nearby stores and restaurants have received little attention in the literature. Yet the 85 percent of college students nationwide who live off campus,¹⁷ as well as those who live on campus, have significant exposure to these campus food outlets and may be influenced by these food environments in important ways. In particular, students living off campus are often limited to using only these alternative food options while on campus since they may not participate in prepaid meal plans.

In addition, campus food outlets may compete with fast food restaurants and other retail food outlets for students' patronage. Campus food venues often offer many energy-dense products similar to fast food (e.g., hamburgers, French fries, pizza, soda pop), and traditional fast food restaurants may also be found in campus à la carte facilities or surrounding areas. Young adults are frequent consumers of fast food^{7,8} and heavily targeted by fast food marketing.⁶ Fast food consumption has consistently been shown to result in poor dietary quality and significant weight gain.^{7,18-25} In contrast, research has shown that adolescents and young adults who prepare food at home have healthier dietary patterns than those who eat at restaurants or eat "on the run."²⁶⁻²⁸

Importantly, no empirical work to date has explored the food/beverage purchasing habits of students living off campus (i.e., how often they purchase food/beverages from campus area venues versus from traditional fast food restaurants or bringing food from home) and their association with dietary quality. This study draws from a diverse sample of two-year and four-year college students living off campus in order to 1) quantify the prevalence of purchasing campus area foods/beverages, purchasing fast food, and bringing food from home; and 2) examine the dietary intake and meal patterns of college students who frequently perform these behaviors. Based on previous research in other populations, it was hypothesized that frequency of purchasing behaviors would differ by student characteristics (e.g., full-time/part-time status, living independently versus in parent/family home, age, socioeconomic status, etc.). In addition, it was hypothesized that students who frequently purchased campus area food/beverages, frequently consumed traditional fast food (e.g.,

McDonald's, Burger King, Hardees, etc.), or infrequently brought food from home would exhibit indicators of poorer dietary quality (e.g., lower consumption of fruits, vegetables, fiber, calcium, and dairy; higher consumption of fat and added sugars; and more meal skipping) compared to students who engaged in these behaviors less (campus area; fast food) or more (food from home) frequently.

Methods

Design

The Student Health and Wellness Study was a cross-sectional study of nutrition- and weight-related issues among a diverse convenience sample of students enrolled at a two-year community college and a public four-year university in the Twin Cities metropolitan area of Minnesota. Between March and May 2010 a diverse group of trained data collectors set up recruitment tables on campus and approached college students to invite them to participate. Students interested in participating were given “pass codes” to enter a secure online survey assessing diet, physical activity, weight control behaviors and personal, social, and environmental factors that may influence these behaviors. A team of experts developed the survey, which included items adapted from previous studies and formative work with young adults. All items were piloted with young adults prior to data collection. Test-retest reliability was assessed for a large proportion of items with 48 similarly-aged young adults recruited for a related study.^{29,30} The survey took approximately 30 minutes to complete, after which participants had their height, weight, and body composition measured on campus and received a \$50 gift card for their participation. Participants were also entered in a lottery to win an Apple iTouch™ device. The [BLINDED FOR REVIEW] Institutional Review Board approved the study protocol. All participants provided informed consent prior to participation.

Sample

Because students living on campus have access to prepaid meal plans that may affect their food purchasing and dietary patterns (i.e., measures of food intake), the sample was restricted to students living off campus. The final sample size for this analysis was 1,059 (587 two-year students and 472 four-year students) after excluding 130 students who reported living in on-campus housing (including fraternities and sororities), and 12 students with missing data on place of residence.

Participants' mean age (SD) was 21.9 (5) years, 53% were female, and the self-reported racial/ethnic composition was 41% White; 19% Black; 27% Asian; and 13% other race/ethnicity (including Hispanic). Study participants represented more racial/ethnic minorities and were younger than the overall student populations at each school. Gender did not differ between study samples and enrolled students at either school.³¹

Measures

Campus area food/beverage purchases were measured by the number of days per week participants reported 1) “buying food from the campus center” (two-year students only), 2) “buying food from another campus restaurant or university dining facility where you pay as you go (for example, [student] union)” (four-year students only), 3) “buying food from a vending machine on campus,” 4) “buying a beverage on campus,” and 5) “buying food or a beverage from a restaurant or store within walking distance of campus” during a normal week (response range: zero to seven). These items were adapted from the IDEA study, a large longitudinal study of adolescents transitioning from high school to post-high school.³² Due to differences between dining facilities at each campus, the first two items were

combined into one variable defined for all respondents (hereafter referred to as buying food from à la carte dining facilities).

Fast food consumption was assessed from participants' response to a question adapted from Project EAT, a longitudinal study of eating and activity behaviors among adolescents: "During the past seven days, how often did you eat a meal at a fast food restaurant (like McDonald's, Burger King, Hardees, etc.)?" (response options: never, one or two times, three or four times, five or six times, seven times or more).^{25,33,34} This measure refers to traditional, branded fast food restaurants. Bringing food from home was measured by the number of days per week participants reported "bringing food from [their] home (or living space) to eat on campus," during a normal week (response range: zero to seven); this item was also adapted from the IDEA study.³² These three measures (campus area food/beverage purchasing, fast food consumption and bringing food from home) are referred to collectively as food/beverage purchasing behaviors.

Consistent with previous studies, participants were classified as frequent consumers if they consumed fast food 3 times/week.^{20,23-25,28} The same criterion was applied to the frequency of purchasing campus area food/beverages and bringing food from home. A summary measure of campus area food/beverage purchases was also constructed: Participants were classified as frequent campus area purchasers if they reported making 3 purchases per week from any one of the four types of campus area measures (i.e., food from à la carte dining facilities, food from vending machines, beverages purchased on campus, and food/beverages from nearby restaurants/stores).

Self-reported demographic characteristics included full-time or part-time enrollment, two-year or four-year student, place of residence (parent/family home, rent/share rent, or homeowner), gender, age, race/ethnicity, and two measures of socioeconomic status: Difficulty living on household income (not at all or somewhat difficult ["low"] versus very/extremely difficult or impossible ["high"]) and whether students received public assistance.

Participants self-reported dietary behaviors for the previous 30 days using two validated screeners developed by the National Cancer Institute:³⁵ 1) the Five Factor Screener, which assesses consumption of fruits and vegetables, calcium, dairy, fiber, and added sugars; and 2) a modified version of the Percentage Energy from Fat Screener,³⁶ which assesses usual intake of foods that are the most important predictors of energy intake from fat (e.g., eggs, sausage, salad dressings, etc.). From these dietary screeners, summary variables (i.e., fruits and vegetables (servings, excluding French fries), dietary fiber (grams), added sugars (teaspoons), calories from fat (percent), dairy (servings) and calcium (mg)) were calculated. These summary measures have been validated to provide estimates comparable to 24-hour dietary recalls.^{35,37} Meal frequency was assessed using two survey items indicating the number of days in a typical week participants reported eating breakfast and an evening meal (range: zero to seven). These measures have been linked to dietary quality in studies of adolescents and young adults.^{38,39}

Analysis

All summary dietary intake variables, except calories from fat, were log-transformed before analysis due to their right-skewed distribution. Observations with missing data or implausible values were excluded (<5% of observations for most dietary intake variables; 9% and 14% of fiber and calcium observations, respectively, due to exclusion of higher numbers of implausible values); sample sizes for analyses are presented in the tables. Chi-square and t-tests compared the socio-demographic characteristics and dietary patterns of students by their frequency of each purchasing behavior. Linear regression examined the independent association of each purchasing behavior with dietary intake by simultaneously

controlling for campus area food/beverages, fast food, and food from home and adjusting for socio-demographic characteristics. A Bonferroni correction was used to account for tests of multiple dietary outcomes, yielding a significance level of $\alpha=0.05/8=0.00625$. All analyses were conducted using Stata version 10.1 (StataCorp, College Station, TX, 2009).

Results

Prevalence of food purchasing behaviors

A considerable number of students frequently purchased food/beverages on or near campus, with the most frequent purchase being beverages (27% purchased 3 times/week) (table 1). About one-fifth of the sample purchased food from à la carte dining facilities and food/beverages from restaurants or stores near campus 3 times/week. Vending machines were the least utilized source of campus food, with half of students (51%) never purchasing food from them. Across all types of campus area purchases, approximately 45% of students made 3 purchases/week from at least one campus area source (table 2). Bringing food from home to consume on campus was also common, with 46% of students doing so 3 times/week. In contrast, only 22% of students reported purchasing fast food (e.g., McDonald's, Burger King, Hardees, etc.) 3 times/week.

Socio-demographic characteristics

Table 2 shows the proportion of students who performed each purchasing behavior 3 times/week by socio-demographic characteristics. Compared to about one-third of part-time students, nearly half of full-time students frequently purchased campus area food/beverages or brought food from home to eat on campus. Four-year students were less likely than two-year students to purchase fast food and more likely to bring food from home to eat on campus 3 times/week ($p<0.001$). No differences in purchasing behaviors were found for age or sex except a higher frequency of bringing food from home among women (52% versus 40% for men).

Over half (52%) of students living in their parent or family home frequently purchased food/beverages on campus, while 32-36% of renters and homeowners did so ($p<0.001$). White students were the least likely to frequently purchase campus area food/beverages and fast food, and Blacks were the most likely ($p<0.001$). Only one significant difference in purchasing behaviors was found by socio-economic status: Students receiving public assistance were nearly twice as likely as those not receiving assistance to frequently purchase fast food ($p<0.001$).

Dietary patterns

In unadjusted analyses, frequently purchasing campus area food/beverages was associated with higher consumption of fat and added sugars ($p<0.001$) and lower consumption of dairy ($p=0.005$) compared to infrequent campus area purchasing (table 3). Similarly, eating fast food 3 times/week was associated with higher consumption of fat and added sugars ($p<0.001$). Students who frequently brought food from home exhibited lower consumption of fat and added sugars and higher consumption of dairy, fruits and vegetables, calcium, and fiber ($p<0.001$).

Students who frequently purchased campus area food/beverages and fast food exhibited more meal skipping than students who did not frequently perform these behaviors ($p<0.001$) (table 3). In contrast, students who frequently brought food from home consumed breakfast approximately one more day per week than those who infrequently brought food from home ($p<0.001$).

After controlling for all three purchasing behaviors (campus area, fast food, and bringing food from home) simultaneously, campus area and fast food purchasing were both independently associated with higher consumption of fat and added sugars ($p < 0.001$) (table 4). Frequent campus area purchasing also significantly predicted lower frequency of breakfast consumption ($p < 0.001$). Consistent with unadjusted findings, bringing food from home was independently associated with lower fat and added sugar intake ($p < 0.01$); higher intake of dairy, fruits and vegetables, calcium, and fiber ($p < 0.001$); and greater frequency of breakfast consumption ($p < 0.001$).

Discussion

Regular purchases of campus area food and beverages were common among this sample of college students living off campus. As expected, full-time students, who likely spend more time on campus than part-time students, were more likely to purchase campus area food/beverages regularly. Students living in their parent or family home were also more likely to make frequent campus area purchases than those living independently, indicating that perhaps these students have not yet taken responsibility for advance meal preparation and planning.

This sample of college students appeared to make particularly unhealthy dietary choices when purchasing food/beverages around campus. Frequent campus area purchasing was associated with diets higher in fat and added sugars and more meal skipping, mirroring results found for fast food purchasing. These findings are unsettling because frequent fast food intake has been consistently linked to poor health behaviors and outcomes, including excess weight gain.^{7,18-25,28} This analysis suggests that unhealthy food/beverage options on or near campus may contribute to unhealthy diets among college students in a manner similar to that of traditional fast food.

Research on primary and secondary school environments has found that changes to the overall healthfulness of foods and beverages offered (e.g., through establishment of nutrition guidelines), as well as efforts to encourage students to make healthier choices (e.g., through point of purchase labeling and price incentives for healthier foods), can improve dietary intake of students.^{40,41} The few studies that have evaluated implementation of similar policies and interventions in post-secondary settings suggest that they may be successfully adapted to this environment;⁴²⁻⁴⁷ however, policy changes will likely need to go beyond information dissemination (i.e., point-of-purchase menu labeling) and improve the healthfulness of menus as a whole in order to make large changes in college students' dietary behaviors.⁴⁸ Given the uniqueness of food environments in and around post-secondary campuses, which include a variety of à la carte and vending options, all-you-can-eat dining halls, and full-service and fast food restaurants, policy and environmental change strategies tailored to these environments may be needed.

Another important finding from this study was that nearly half of students living off campus frequently brought food from home to eat on campus. These students exhibited better dietary patterns on nearly all measures examined, even when adjusting for fast food and campus area food/beverage purchases. These results are consistent with other studies that have found consuming food prepared at home to be associated with better dietary quality.^{26,27} The large size and relative socio-demographic heterogeneity of this group indicates that it is not necessarily a select group with particularly positive dietary behaviors and clearly identifiable characteristics; rather, students from all racial/ethnic backgrounds, socio-economic statuses, and ages were equally likely to bring food from home to eat on campus. These findings support prioritizing regular home food preparation and meal planning in nutrition promotion efforts targeting this age group. Developing meal preparation skills and forming healthy

meal habits may help positively shape young adults' diets both during their time as a student and as they transition out of post-secondary institutions.

This is the first study of its kind to examine food/beverage purchasing patterns from multiple types of campus area venues and to focus exclusively on students who live off campus, a group previously assumed to have little contact with the campus food environment.^{10,12-15} The present findings challenge this assumption and highlight the importance of intentionally targeting this group in health promotion efforts. Compared to those living in on-campus housing, students living off campus tend to have lower socio-economic status and exhibit poorer health behaviors and outcomes.⁴⁹ They may also be disconnected from campus health and wellness resources and have greater responsibility for food acquisition and meal preparation. Yet campus health promotion activities may unintentionally exclude this vulnerable group by taking place in dining halls, fitness centers, and residence halls. Efforts to improve the dietary behaviors of college students should therefore explore delivery methods that reach all students, such as changes to the broader campus food environment, campus-wide social media campaigns, and internet-based interventions.

Strengths of this study include a large and diverse sample drawn from a community college and a public university in a major metropolitan area and the use of validated dietary assessment methods. Limitations include the following: First, the results may not be generalizable to campuses in more rural settings, where fewer off-campus food/beverage options may be available or where fewer students live off campus. It is likely that students in these settings may purchase campus area food/beverages with even greater frequency than what was found in this study. In addition, the use of a convenience sampling approach may have resulted in a sample that is more interested in health than the general population.

Second, the general nature of the survey items assessing purchasing behaviors does not address the quality or quantity of food/beverages purchased or brought from home. For example, students who regularly bring lunch to campus would respond the same way as students who regularly bring a portable snack, and students who regularly report purchasing food at an à la carte dining facility could be eating either a meal or a snack. In addition, the Student Health and Wellness Study survey did not measure frequency of lunch consumption, which would have been interesting to consider in this analysis. It is also possible that the measures for fast food and campus area food/beverage purchasing could be capturing some of the same behaviors to the extent that fast food restaurants are located on or near campus. Despite this limitation, clear differences were found in students' dietary patterns across purchasing behaviors, indicating that the source of food/beverages itself influences students' dietary intake in a rather robust way.

Third, this study used cross-sectional data, prohibiting conclusions about causality. It cannot be determined whether frequently purchasing campus area food/beverages leads to poorer dietary patterns or whether students who exhibit poorer dietary patterns tend to purchase campus area food/beverages more often. However, post-hoc analyses found no differences across purchasing behaviors in students' perception of the availability of healthy food/beverages on campus (data not shown). This finding suggests that the decision to purchase campus area food/beverages may be influenced by factors other than perceived healthfulness, such as convenience, cost, and taste.⁵⁰ If this is true, colleges and universities are in a unique position to positively impact the diets of their students through environmental changes that make healthy food and beverages available, affordable, and appetizing.

Given young adults' poor dietary habits and high risk of weight gain, improving the healthfulness of campus food availability and purchasing is an overlooked opportunity for nutrition promotion and obesity prevention efforts. Despite the relative differences in dietary quality identified in this paper, very few young adults overall meet national recommendations for dietary intake.^{6,9} College and university administrators, food service providers, public health professionals, students, and public and private community partners should work together to examine how existing school food policies can be adapted to post-secondary settings and to develop new policies tailored to post-secondary campuses.

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So what?

What is already known on this topic?

Purchasing food and beverages on college campuses may influence young adults' dietary quality, but most studies only examined the influence of prepaid dining halls on the diets of students living on campus.

What does this article add?

This article examined multiple food and beverage purchasing behaviors on and off campus and focused exclusively on students living off-campus. Students who frequently purchased food/beverages on or near campus had poorer dietary patterns that mirrored results for frequent fast food consumers. Students who frequently brought food from home to consume on campus had healthier dietary patterns.

What are the implications for health promotion practice or research?

Health promotion efforts on college campuses should consider policy and environmental strategies to increase healthy food availability and purchasing on campus. In addition, prioritizing regular home food preparation and meal planning in nutrition promotion efforts may help positively shape young adults' diets.

Table 1
College students' frequency of food and beverage purchasing, Student Health and Wellness Study

Campus area purchasing	n*	Number of days/week				
		0 %	1 to 2 %	3 to 4 %	5 or more %	
A la carte campus dining facility	1,042	38.1	40.7	17.3	3.9	
Nearby restaurant/ store	1,031	44.0	35.7	15.8	4.5	
Vending machine	1,039	50.6	35.7	10.5	3.2	
Beverage	1,029	35.1	38.0	20.5	6.4	
Fast food purchasing	1,048	30.7	47.1	14.8	7.3	
Food brought from home	1,036	25.1	28.8	26.4	19.8	

* Sample sizes vary due to missing data.

Table 2
College students' food and beverage purchasing behaviors by socio-demographic characteristics, Student Health and Wellness Study

	n*	Campus area purchasing 3 times/week		Fast food purchasing 3 times/week		Food brought from home 3 times/week	
		%	p-value	%	p-value	%	p-value
All Students	1059	44.6		22.1		46.1	
Enrollment status							
Part-time	224	32.7		27.5		34.6	
Full-time	825	47.2	<0.001	20.4	0.003	49.5	0.001
Student type							
2-year student	587	43.1		27.9		38.4	
4-year student	472	46.5	0.565	15.1	<0.001	55.6	<0.001
Gender							
Male	507	47.5		25.8		40.2	
Female	546	41.7	0.035	18.7	0.003	51.6	0.001
Age							
17-20	586	48.5		24.9		43.8	
21 or older	469	39.7	0.007	18.5	0.062	49.2	0.020
Residence							
Parent/family home	579	51.9		24.9		45.5	
Rent/share rent	413	36.3		17.7		47.7	
Homeowner	67	32.3	<0.001	25.4	0.024	42.2	0.648
Race/ethnicity							
White	415	34.8		12.9		51.3	
Black	213	54.4		40.9		36.8	
Asian	293	51.5		22.3		44.5	
Other	138	44.5	<0.001	21.0	<0.001	47.8	0.053
Difficulty living on household income							
Low	837	44.9		21.1		46.7	
High	220	43.3	0.542	25.7	0.046	43.7	0.544
Receives public assistance							
No	926	43.6		20.4		46.8	
Yes	99	52.6	0.043	38.5	<0.001	36.2	0.066

* Sample sizes vary due to missing data.

Table 3
College students' dietary patterns by food and beverage purchasing behaviors, Student Health and Wellness Study

	Campus area purchasing (n=579)		Fast food purchasing (n=816)		Food brought from home (n=478)	
	<3 times/ week (n=466)	p-value	<3 times/ week (n=232)	p-value	<3 times/ week (n=558)	p-value
Dietary intake						
Calories from fat (%)	29.1	30.6 <0.001	29.2	31.7 <0.001	29.1	<0.001
Added sugar (tsp) *	13.4	17.2 <0.001	13.9	19.6 <0.001	13.6	<0.001
Dairy (servings) *	1.3	1.2 0.006	1.3	1.2 0.879	1.4	<0.001
Fruit/vegetables (servings) *†	3.4	3.4 0.629	3.5	3.3 0.257	3.7	<0.001
Calcium (mg) *	709	672 0.097	688	711 0.395	737	<0.001
Dietary fiber (g) *	14.1	13.8 0.572	13.8	14.6 0.157	14.8	<0.001
Meal frequency						
Breakfast (days/week)	4.6	3.6 <0.001	4.3	3.5 <0.001	4.7	<0.001
Evening meal (days/week)	6.3	5.9 <0.001	6.2	5.7 <0.001	6.2	0.018

* Analysis conducted on log scale. Values in table have been back-transformed to original scale.

† Excludes French fries.

Table 4
Adjusted association between college students' food and beverage purchasing behaviors and dietary patterns, Student Health and Wellness Study*

Outcome	n	Campus area purchasing		Fast food purchasing		Food brought from home	
		β	p-value	β	p-value	β	p-value
Dietary intake							
Calories from fat (%)	975	1.43	<0.001	1.79	<0.001	-0.97	0.001
Added sugar (tsp) [‡]	952	0.16	<0.001	0.17	<0.001	-0.08	0.005
Dairy (servings) [‡]	969	-0.11	0.018	0.09	0.111	0.19	<0.001
Fruit/vegetables (servings) [‡]	943	0.02	0.669	-0.08	0.078	0.18	<0.001
Calcium (mg) [‡]	857	-0.06	0.085	0.08	0.046	0.14	<0.001
Dietary fiber (g) [‡]	903	-0.03	0.337	0.04	0.205	0.16	<0.001
Meal frequency							
Breakfast (days/week)	982	-0.78	<0.001	-0.24	0.177	0.96	<0.001
Evening meal (days/week)	982	-0.22	0.016	-0.21	0.049	0.09	0.289

* Models adjusted for student type, enrollment status, age, race/ethnicity, gender, residence, difficulty living on household income, and public assistance receipt.

[‡] Analysis conducted and presented on log scale.

[‡] Excludes French fries.