



HHS Public Access

Author manuscript

J Acad Nutr Diet. Author manuscript; available in PMC 2017 September 01.

Published in final edited form as:

J Acad Nutr Diet. 2016 September ; 116(9): 1450–1457. doi:10.1016/j.jand.2016.04.004.

Factors related to the high rates of food insecurity in among diverse, urban college freshmen

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Abstract

Objective—To examine the prevalence of food insecurity and associations with health outcomes among college freshmen.

Methods—A diverse sample of freshmen (n=209) attending a large southwestern university and living in campus residence halls completed online surveys; anthropometrics were measured by trained staff. Using mixed logistic regression, associations were examined between food insecurity and health outcomes, adjusting for sociodemographics and clustering of students within residence halls.

Results—Food insecurity was prevalent, with 32% reporting inconsistent access to food in the past month and 37% in the past three months. Food insecure freshmen had higher odds of depression (OR=2.97; 95% CI=1.58, 5.60) compared to food secure students. Food insecure freshmen had significantly lower odds of eating breakfast, consuming home-cooked meals, perceiving their off-campus eating habits to be healthy, and receiving food from parents, (p<0.05).

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No conflicts of interest to report.

Conclusions—Interventions are needed to support students struggling with food insecurity, as it is related to health outcomes.

Keywords

Food insecurity; college students; eating behaviors; obesity

Introduction

Food insecurity, or the lack of consistent access to healthy, safe food, is a critical public health problem facing 48.1 million American households.¹ Food insecurity has been associated with poor nutritional health,² increased risk of obesity for some,³ and chronic disease.⁴ Although post-secondary education may once have been primarily accessible to only higher socio-economic groups, higher education is becoming more and more accessible to all populations including those from low income households.^{5–8} Transitioning to college comes with new independence and stressors,^{9, 10} including shifts in financial burdens,^{11, 12} which may result in higher rates of food insecurity. Others have shown that health disparities are prevalent in college populations;^{13, 14} however, very few studies have been conducted on food insecurity in U.S. college students.^{15, 16}

To date, there has been limited scientific work on food insecurity among college students, and that work has focused almost exclusively on demographic and economic correlates. Food insecure students face multiple social and economic barriers that may be related to their health and well-being. For example, food insecurity has been shown to be 1.5 times higher among Black and Hispanic students compared to White or Asian students.¹⁷ Food insecure students were more likely to receive financial aid,¹⁵ not live with family,^{14, 18, 19} to have jobs while taking classes,^{17, 19} and to have lower grades.¹⁶

To a limited extent, food insecurity has been shown to be associated with some aspects of health among college students. To date, there has only been one peer reviewed study of food insecurity and health correlates among U.S. college students.¹⁶ This cross-sectional study found that food insecure students were more likely to report their health as being ‘fair’ or ‘poor.’ Studies from Australia have shown lower fruit and vegetable consumption among food insecure students² and null associations between weight status and food insecurity.^{2, 19} Although it is likely that college students in other international settings may differ from those in the U.S., more research is needed in this area.

Of the three published peer-reviewed studies on food insecurity among U.S. college students,^{14–16} two excluded college freshmen entirely,^{14, 15} and none examined food insecurity specifically among college freshmen living in residence halls. Given the multiple changes occurring during the transition from high school to college and the move away from home, freshmen residing in residence halls may be an important population to study. For many students, this transitional period marks the first time they have had to make decisions and solve problems without assistance from their parents. Their newfound autonomy is coupled with the everyday stressors of a new environment, school, and social pressures.²⁰ The primary purpose of this study was to describe the prevalence of food insecurity among college freshmen living in residence halls in an urban setting at one of the largest, most

diverse public universities in the U.S., and to examine differences between food secure and food insecure college freshmen on factors related to health behaviors and outcomes. Findings will help guide prevention and intervention efforts, as well as future research, on this vulnerable population.

Methods

Study design

This manuscript is based on a secondary analysis of data from a pilot study for a large, NIH-funded study, SPARC (Social impact of Physical Activity and nutrition in College), aimed at assessing the nutrition and physical activity behaviors of college freshmen. College freshmen living in two residence halls during the fall and spring of the 2014–2015 academic year were recruited to participate via floor meetings held at the residence halls. In total, 533 students were living in the two residence halls. Of those, 278 (52.2%) attended their floor meetings where they were invited to participate in the study. The participation rate among those who were invited was 79.5% (n=221); the overall student response rate from the two residence halls was 41.5% (221/533). The demographics of the students participating compared to those in the overall population of students living in the targeted residence halls were slightly more diverse, with 53.6% non-white participants vs. 47.7% non-white, respectively. Participants were compensated up to \$50. All study protocols were approved by the Arizona State University Institutional Review Board.

Measures

All participants completed a 128-item online survey with questions on demographics, dietary and physical activity behaviors, and social-environmental factors related to nutrition, physical activity, and weight. The survey took approximately 25–30 minutes to complete. One week after the initial survey, the questionnaire was administered to a subsample (n=55), and test-retest correlations were computed (see Table 1). In addition to the survey measures, trained researchers measured participant weight and height using standard research protocols. Of the 221 students who responded to the survey, 11 students who were not freshman and one transgender participant were removed, yielding an analytic sample of 209 respondents.

Food insecurity—The measure of food insecurity used was adapted from the U.S. Household Food Security Survey Model²¹ and a validated two-item screening instrument.²² In order to understand the temporality of changes related to food insecurity that may occur during the freshman year in college, the time frame in the validated question was adapted²³ and changed the framing of the question from “we” to “I”. Participants were asked, “Within the past month, I worried whether my food would run out before I got money to buy more” and “Within the past month, the food I bought just did not last and I did not have money to get more.” Participants were asked the same question again but with a 3-month reference frame. Students giving an affirmative answer to either question were categorized as food insecure in the past month or the past three months, respectively.

Weight status—Participant weight and height were measured by trained research assistants. Weight was recorded to the nearest 0.1kg using portable Seca™ flat scales (models 874 or 869) and height to the nearest 0.1cm using portable Seca™ stadiometers (model 217). If the two weights or heights were off by more than 0.5kg or 0.5cm, respectively, a third weight or height was taken. BMI was calculated using weight and height measurements. Participants with a BMI ≥ 25 kg/m² were classified as overweight/obese.²⁴

Health behaviors—An array of health behaviors and attributes were assessed using survey items adapted from those used in national surveillance systems or other large-scale research efforts in the U.S. (see Table 1). Participants' consumption of *breakfast*, *fast food*, and *home cooked meals* were assessed. These measures of eating behaviors were then dichotomized at the medians. The breakfast measure was coded as four or more days per week vs. less. Fast food and home-cooked meals were coded as two or more days per week vs. less. *Fruit and vegetable* intake items were summed, and dichotomized to five or more fruits and vegetables per day vs. less. Participants rated their perception of the healthfulness of their *eating behaviors on and off campus*.²⁵ These items were recoded to percent agree vs. percent disagree. Participants who reported ever having consumed alcohol were asked about their *binge drinking habits*.²⁶ Responses were converted to presence (yes/no) of binge drinking.

Access to food from parents—Participants were also asked about *access to food from parents* (see Table 1); responses were dichotomized to two or more times per semester vs. less.

Mental health—*Stress*,²⁷ *depression*,²⁸ and *anxiety*²⁸ were three mental health disorders investigated in this study. The response options for the stress and depression scales were changed slightly from the original items (from never/almost never/sometimes/fairly often/very often to never/rarely/sometimes/often).

Sociodemographics—Data on participants' gender, age, race/ethnicity, meal plan, Pell grant status, highest parental education, and current residence hall were collected. Age was determined from the participant's date of birth. Every participant was asked if he or she was a Pell grant recipient, with responses coded as yes or no. Due to low numbers in some categories, race/ethnicity was categorized as Hispanic or non-Hispanic white, non-Hispanic Black, non-Hispanic Asian, Mixed/other.²⁹ Students were asked to indicate which meal plan they were enrolled in ranging from 8 meals per week to unlimited meals.³⁰ Participants were asked to report the highest level of education attained by their parents using seven response options, which were then grouped by the highest educational level attained by either parent: high school or less, some college, and bachelor's degree or higher.

Statistical Analysis

Chi-square and t-tests were used to examine bivariate associations of weight status, health behaviors, frequency of parents providing food, mental health variables, and sociodemographic factors with food insecurity. Mixed effects logistic regressions were then used to model the association of food insecurity with measures of weight status, eating

behaviors, frequency of parents providing food, and mental health variables, adjusted for gender, age, race/ethnicity, meal plan, Pell grant status, highest parental education, and the clustering of students within residence halls. Covariates were treated as fixed effects and residence hall-level intercepts were treated as random effects. All analyses were conducted using R statistical software (version 3.2.3, 2015, R Core Team, 2015). Statistical significance was determined at $p < 0.05$.

Results

Data were collected from 209 college freshmen (mean age=18.8±0.5 years; 62% female; see Table 2). The percentage of participants who reported food insecurity in the previous month was 32% (data not shown), and 37% of participants reported food insecurity in the previous three months. There were no differences in the odds of reported food insecurity by overweight status, reported healthy eating on campus, or stress. Bivariate analyses, however, showed that students who rarely consumed breakfast, students who rarely ate home-cooked meals, and students with higher levels of depression were significantly more likely to report food insecurity in the past three months ($p < 0.05$, Table 2). Students who often consumed fast food, who reported unhealthy eating habits off campus, and whose parents did not regularly send/purchase food for them were more likely to report food insecurity in the last three months ($p = 0.09$, $p = 0.07$, and $p = 0.10$, respectively).

Multivariate analyses show that students reporting food insecurity in the past three months, compared to those who did not report food insecurity, had significantly higher odds of reporting depression (OR: 2.97; 95% CI 1.58, 5.60; see Table 3) and anxiety (OR: 1.49; 95% CI 0.99, 6.66). The odds of consuming regular breakfast (OR: 0.41; 95% CI: 0.22, 0.77) and healthy eating off campus (OR: 0.46; 95% CI: 0.24, 0.88) was inversely related to food insecurity. Associations of food insecurity with being overweight, fast food consumption, fruit and vegetable consumption, healthy eating on campus, binge drinking, and stress were not significant.

Discussion

This study examined the prevalence of food insecurity and its association with health outcomes among a diverse group of college freshmen living in residence halls. One in three students reported being food insecure, and food insecurity was associated with higher odds of mental health issues, unhealthy eating, and alcohol use behaviors. Findings provide insights on an understudied population in need of additional support to prevent adverse outcomes related to food insecurity.

Because college freshmen living in residence halls have access to institutional supports including personnel and programming dedicated to assisting them with the transition to university life, safe high quality housing, and university meal plans, they may be perceived as being protected from stressors that are often linked to poverty, such as food insecurity. Despite having access to these resources, one-third of the college freshmen in this study reported inadequate access to food, similar to the rates that others have reported in college

populations in both peer-reviewed and non-peer-reviewed literature,^{14, 15, 17} and significantly higher than the national average for children and adults.¹

Dealing with food insecurity has significant implications that may affect the long-term health and well-being of students. For example, among children, adolescents, and college students, food insecurity has been linked to poorer academic success.¹⁶ Among adults, food insecurity has been related to higher risk of poor dietary quality,³¹ binge eating,³¹ chronic disease,⁴ and lower work productivity.³² Given that this study found the odds of anxiety and depression to be almost 3 times as high among food insecure freshmen as compared to their peers, it is important to consider how the combination of food insecurity and mental health issues might affect learning and ultimate success as a student. More studies are needed to examine the relationship of food insecurity to academic achievement among college students, as well as long-term health and career effects. In addition, students reporting mental health issues also report higher levels of emotional eating,³³ which may in turn impact their weight gain during college.³⁴ While a relationship between food insecurity and weight status was not observed in this cross-sectional study, over time, it is possible that the unhealthy eating behaviors reported by food insecure freshmen in the current study may result in excess weight gain. Future research should examine longitudinal effects of food insecurity on weight and weight-related behaviors, at least through the freshmen year and until graduation.

Food insecure students likely do not have the resources to fulfill their needs (e.g., money for higher priced meal plan, material support from family).¹⁵ As higher education becomes more accessible, college student populations are becoming more diverse, with more first-generation college students,⁶ who along with their families may need even more support navigating the transition to college life.³⁵ Unlike K-12 schools where food is provided to students at free/reduced rates for those in need,³⁶ many universities have limited supports for students who are in need of food assistance. Some universities have instituted innovative solutions such as on-site food pantries for students who do not have consistent access to food.³⁷ While emergency food (food pantries and food banks) provide short-term solutions for students in need, systems providing long-term benefits (e.g., budgeting and meal planning skills), which may better support students in need should be developed and tested. For example, universities could test the effectiveness of more affordable meal plans with minimum requirements that would cover all meals and/or subsidized breakfast or lunches for students to increase students' access to healthy food (as the National School Lunch Program does for low-income K-12 students). Given decreased public funding for higher education, stakeholder buy-in and creative funding solutions would need to be explored. More opportunities for work placement through university and/or community partnerships may also be effective in addressing potential income shortfalls that students might face. Finally, considerations to expanding the student eligibility criteria³⁸ for participation in the SNAP program may be helpful in decreasing food insecurity among college students.

Limitations

With a cross-sectional survey conducted in a convenience sample, this study has several limitations. The lack of temporally ordered measurement precludes making any causal

statements, and findings may not be generalizable to other populations of college freshmen or college students (e.g., students at private institutions). All items were self-reported, and may be prone to recall, social desirability, biases, as well as misinterpretation of questions (e.g., students may have perceived dining hall food to be “home cooked”); however, test-retest reliabilities for the study measures were generally good. The food insecurity items used in this study have been validated among adults with children using a different time frame;²² college students may respond to these items differently. Despite the limitations of this work, this study yields important contributions to the field, particularly given the paucity of research to date on the issue of food insecurity among college students.

Conclusion

A significant portion of college freshmen living in residence halls may face food insecurity. When addressing healthy eating with college students, considerations should be made for their limited resources. It cannot be assumed that these students have access to high quality foods, and may even be struggling with regular access to foods. College students have a reputation for engaging in unhealthy eating habits. These habits, however, may in part reflect choices based on barriers to healthier eating, including lack of consistent access to affordable nutritious foods. More research is needed to understand the scope of the prevalence of food insecurity among college students. Regardless, interventions are needed to better support young people in college who have inconsistent access to healthy foods.

Acknowledgments

We would like to thank the students for taking the time to participate in this study. We would like to thank the devilSPARC research team for their assistance in collecting the data. This study was supported by the NIH Common Fund from the Office of the Director and the Office of Behavioral and Social Sciences Research, grant number 1DP5OD017910-01 (PI: M. Bruening). The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute of Health.

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Table 1

Key measures and test-retest correlations¹ used to examine the association between food insecurity and health behaviors among college freshmen

Variables	Measure	Test-retest n=55
Breakfast consumption	In the past 7 days, how often did you eat breakfast? (<i>Response options: never, 1 day, 2–3 days, 4–6 days, and every day</i>)	0.79
Fast food consumption	In the past 7 days, how often did you eat fast food? (<i>Response options: never, 1 day, 2–3 days, 4–6 days, and every day</i>)	0.60
Home cooked meals eaten	In the past 7 days, how often did you eat home cooked meals? (<i>Response options: never, 1 day, 2–3 days, 4–6 days, and every day</i>)	0.58
Fruit consumption	Thinking back over the past week, how many servings of fruit did you usually eat on a typical day? (A serving is half a cup of fruit or 100% fruit juice or a medium piece of fruit.) (<i>Response options: 0 to 6 or more servings per day</i>)	0.63
Vegetable consumption	Thinking back over the past week, how many servings of vegetables did you usually eat on a typical day? (A serving is half a cup of cooked vegetables or one cup raw) (<i>Response options: 0 to 6 or more servings per day</i>)	0.60
Healthy eating habits on campus	How would you rate your eating habits on campus? (<i>Response options: Very unhealthy, Unhealthy, Healthy, Very healthy</i>)	0.64
Healthy eating habits off campus	How would you rate your eating habits off campus? (<i>Response options: Very unhealthy, Unhealthy, Healthy, Very healthy</i>)	0.67
Binge drinking	During the last two weeks, how many times have you had four/five alcoholic drinks in a row? ² (<i>Response options: never to 4 or more days</i>)	0.66
Parents purchase/send food	How often do your parents/guardians typically purchase or send food for you? (<i>Response options: Never, Once per semester, 2–3 times per semester, Monthly, Weekly</i>)	0.61
Stress levels	How often in the past 1 month have you felt: 1) Unable to control the important things in your life; 2) Confident about your ability to handle your personal problems?; 3) Things were going your way?; 4) Difficulties were piling up so high that you could not overcome them? (<i>Response options: Never, Rarely, Sometimes, Often</i>)	0.74
Depression levels	How often in the past 1 month have you felt: 1) Things were hopeless; 2) Overwhelmed by all you had to do; 3) Very lonely?; 4) Very sad; 5) So depressed that it was difficult to function?; 6) Overwhelming anxiety? (<i>Response options: Never, Rarely, Sometimes, Often</i>)	0.89
Anxiety (diagnosed/treated in past 12 months)	In the past 12 months, have you been told by a doctor or health care professional that you have anxiety? (<i>Response options: No; 2. Yes, diagnosed and treated; Yes, diagnosed; Yes, treated</i>)	0.71

¹ Test-retest correlations based on a subsample (n=55) who took the survey a second time one week after their original responses

² Females are asked about four drinks; Males are asked about five drinks.

Table 2

Demographics and key nutrition/health variables by food security status in the past 3 months among college freshmen (n=209)

	Total n=209	Food secure n=131 (63%)	Food insecure n=78 (37%)	p value^a
Gender n(%)				1.00
Male	79 (38)	50 (38)	29 (37)	
Female	130 (62)	81 (62)	49 (63)	
Age in years mean ±SD	18.8 ± 0.5	18.8 ± 0.4	18.8 ± 0.5	0.98
Race/Ethnicity n(%)				0.12
Hispanic	56 (27)	33 (25)	23 (29)	
Non Hispanic White	97 (46)	61 (47)	36 (46)	
Non Hispanic Black	13 (6)	5 (4)	8 (10)	
Non Hispanic Asian	26 (12)	21 (16)	5 (6)	
Mixed/other	17 (8)	11 (8)	6 (8)	
Meal Plan n(%) >8 meals/week	132 (63)	84 (64)	48 (62)	0.82
Pell Grant Status n(%) yes	73 (35)	41 (31)	32 (41)	0.20
Highest parental degree n(%)				0.18
High school or less	37 (18)	28 (21)	9 (12)	
Some college	63 (30)	39 (30)	24 (31)	
Bachelors degree or higher	109 (52)	64 (49)	45 (58)	
Residence Hall n(%)				0.02
A	98 (47)	53 (40)	45 (58)	
B	111 (53)	78 (60)	33 (42)	
Overweight/obese n(%)	70 (33)	39 (30)	31 (40)	0.18
Breakfast consumption				
mean ± SD	3.58 ± 2.54	3.94 ± 2.58	2.96 ± 2.35	0.01
n(%) 4+ days/week	89 (43)	65 (50)	24 (31)	0.01
Fast food consumption				
mean ± SD	1.50 ± 1.58	1.32 ± 1.44	1.81 ± 1.77	0.04
n(%) 2+ days/week	77 (37)	42 (32)	35 (45)	0.09
Home cooked meals eaten				
mean ± SD	1.66 ± 2.05	1.95 ± 2.15	1.17 ± 1.78	0.01
n(%) 2+ days/week	73 (35)	56 (43)	17 (22)	<0.01
Fruit and vegetable consumption				
mean ± SD	3.60 ± 2.42	3.78 ± 2.52	3.28 ± 2.23	0.14
n(%) 5+ servings/day	65 (31)	46 (35)	19 (24)	0.14
Healthy eating habits on campus				0.53
n(%) agree	117 (56)	76 (58)	41 (53)	
Healthy eating habits off campus				0.07
n(%) agree	133 (64)	90 (69)	43 (55)	
Binge drinking (past two weeks)				
n(%) yes	79 (38)	50 (38)	29 (37)	1.00

	Total n=209	Food secure n=131 (63%)	Food insecure n=78 (37%)	<i>p</i> value ^a
Parents purchase/send food (times/semester)				
<i>mean ± SD</i>	2.96 ± 1.43	3.05 ± 1.38	2.81 ± 1.50	0.26
<i>n(% 2+ times/semester)</i>	134 (64)	90 (69)	44 (56)	0.10
Stress levels ^{b, c}				
<i>mean ± SD</i>	2.22 ± 0.64	2.14 ± 0.61	2.37 ± 0.67	0.01
<i>n(% high)</i>	81 (39)	47 (36)	34 (44)	0.30
Depression levels ^{b, c}				
<i>mean ± SD</i>	2.18 ± 0.78	2.06 ± 0.75	2.40 ± 0.80	<0.01
<i>n(% high)</i>	70 (34)	32 (24)	38 (49)	<0.01
Anxiety (diagnosed/treated in past 12 months) ^b <i>n(% yes)</i>	24 (12)	12 (9)	12 (16)	0.24

^a χ^2 and t-test *p*-values compare the difference by food security status and demographics and key variables

^b Total = 208 due to one respondent with missing values

^c On a scale of 1–4, with higher numbers indicating more stress and depression. The score was dichotomized at 2.5 based on the sample distribution, with scores 2.5 and higher categorized as high.

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Table 3

Multivariate mixed effects logistic regression (Odds Ratios and 95% Confidence Intervals) examining the association between food insecurity in the past three month and nutrition/health outcomes among college freshmen (n=209)

	OR	95% CI	P value
Weight status			
Overweight/obese (BMI ≥ 25)	1.37	(0.73, 2.58)	0.33
Health behaviors			
Consume breakfast ≥ 4×/week	0.41	(0.22, 0.77)	0.01
Consume fast food ≥ 2×/week	1.63	(0.87, 3.06)	0.13
Consume home-cooked meals ≥ 2×/week	0.34	(0.16, 0.72)	<0.01
Consume ≥ 5 fruit and vegetables/day	0.58	(0.30, 1.13)	0.11
Healthy eating habits on-campus ¹ (<i>agree</i>)	0.81	(0.44, 1.47)	0.48
Healthy eating habits off-campus ¹ (<i>agree</i>)	0.46	(0.24, 0.88)	0.02
Reported binge drinking in last two weeks	0.93	(0.49, 1.79)	0.84
Food access			
Parents purchase/send food ≥ 2×/semester	0.51	(0.28, 0.94)	0.03
Mental health			
High stress levels (high) ²	1.42	(0.77, 2.60)	0.26
High depression levels (high) ²	2.97	(1.58, 5.60)	<0.01
Anxiety (diagnosed/treated in past 12 months)	1.49	(0.99, 6.66)	0.05

Model controlled for gender, age, race/ethnicity, meal plan, Pell grant status, highest parental education and current residence hall..

¹. Participants reported perceptions of their healthy eating on and off campus, which was recoded to agree vs disagree.

². On a scale of 1–4, with higher numbers indicating more stress and depression. The score was dichotomized at 2.5 based on the sample distribution, with scores of 2.5 and higher categorized as high.

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