HHS Public Access

Author manuscript

Am J Prev Med. Author manuscript; available in PMC 2018 February 01.

Published in final edited form as:

Am J Prev Med. 2017 February ; 52(2 Suppl 2): S151–S160. doi:10.1016/j.amepre.2016.08.021.

Associations of cooking with dietary intake and obesity among SNAP participants

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Abstract

Introduction—Participation in the Supplemental Nutrition Assistance Program (SNAP) may help ease economic and time constraints of cooking, helping low-income households prepare healthier meals. As a result, frequent cooking may be more strongly associated with improved dietary outcomes among SNAP recipients than among income-eligible non-SNAP-recipients. Alternately, increased frequency of home-cooked meals among SNAP participants may be beneficial simply by replacing fast food intake. The objective is to quantify the association between home cooking and fast food with diet intake and weight status among SNAP recipients.

Methods—2015 data from low-income adults aged 19-65y from the National Health and Nutrition Survey, 2007-2010 (n=2,578) was used to examine associations between daily home-cooked dinner and weekly fast food intake with diet intake, including calories from solid fat and added sugar, key food groups (sugar-sweetened beverages (SSBs), fruit, and vegetables), and prevalence of overweight/obesity. Differences in these association for SNAP recipients vs. income-eligible non-recipients were analyzed, as well as whether associations were attenuated when controlling for fast food intake.

Results—Daily home-cooked dinners were associated with small improvements in dietary intake for SNAP recipients but not for non-recipients, including lower SSB intake (-54 kcal/day), and reduced prevalence of overweight/obesity (-6%) ($p<0.05$). However, these associations were attenuated after controlling for fast food intake. Consuming one fast food meal/week was associated with 9.3% and 11.6% higher overweight/obesity prevalence among SNAP recipients and non-recipients, respectively ($p<0.05$).

Conclusion—Strategies to improve dietary intake among SNAP recipients should consider both increasing home cooking and reducing fast food intake.

Background

Policymakers have discussed numerous strategies for improving the dietary intake of participants in the Supplemental Nutrition Assistance Program (SNAP), the largest US feeding program [1], including proposals to restrict the use of SNAP benefits to purchase

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None of the authors have any conflicts of interest of any type with respect to this manuscript

sugar-sweetened beverages (SSB) [2] or programs incentivizing fruit and vegetable purchases.[3, 4] Less attention has been paid to the potential benefits of home food preparation, or "home cooking", despite calls by scholars to return to home cooking as a strategy for improving diet and reducing obesity.[5, 6] There is growing but limited evidence to suggest that cooking is beneficial for improved diet quality,[7-9] and prevention of weight gain and type 2 diabetes.[10]

However, one unanswered question is whether the benefits of home cooking hold for low-income individuals. Home cooking may be more difficult for low-income households, who report financial and time constraints [11-16] and who may not have access to adequate cooking facilities or equipment or knowledge of healthy home-cooking practices.[17, 18] This lack of resources, time, and skill may lead to the use of lower-quality ingredients, less healthy cooking methods like frying [19, 20], or reliance on inexpensive, processed foods [21, 22]. As a result, home-cooked meals among low income households may be less beneficial for dietary intake or obesity.

It is also unclear whether SNAP participation modifies the association between home cooking and dietary intake. On one hand, participation in SNAP provides increased resources to buy higher quality ingredients, such as fresh, local produce [23, 24], or healthy pre-prepared ingredients that may cost more but require less time to prepare (e.g., pre-washed bagged lettuce). Evidence is mixed as to whether SNAP participants cook more than income-eligible non-paticipants, [25-27] and participants could simply use extra funds to buy more unhealthy foods. SNAP participants can also use money saved on groceries to purchase other goods, including away-from-home foods. [28, 29]

This latter point is important, as away-from-home food intake could bias the association between cooking and dietary outcomes if daily cooking is associated with lower away-from-home food, and in particular, lower fast food intake, which has been previously associated with increased energy intake and weight status among adults.[30, 31] In other words, is it home cooking that improves dietary intake and reduces obesity, or does this association simply reflect a reduction in fast food intake?

The objectives of this study are to determine whether the frequency of home-cooked meals (i.e. dinner) is associated with improved dietary intake and weight status, whether these associations differ for SNAP recipients vs. eligible non-recipients, and whether these associations persist after controlling for fast food intake.

Methods

Study Design and Population

This cross-sectional study used data from the 2007-2008 and 2009-2010 National Health and Nutrition Survey (NHANES), which uses a stratified, multistage probability sampling design to study a nationally representative sample of the US civilian non-institutionalized population.[32, 33] This study includes non-pregnant adults aged 19-65 years who were income-eligible to receive SNAP benefits, defined here as adults with family income ≤130% of the Federal Poverty Level (FPL) (n=2,578).

Adults were classified as SNAP recipients if they reported in the Food Security Questionnaire that any member of the household had received Food Stamp or SNAP benefits in the last 12 months[34, 35].

Exposure assessment: weekly frequency of cooking dinner at home

The main exposure, frequency of cooking dinner at home, was defined using data from the Flexible Consumer Behavior Survey module.[36, 37] The relevant question was, "During the past 7 days, how many times did you (or someone else in your family) cook food for dinner or supper at home?" To determine how to model the cooking exposure, the shape of the relationship between weekly frequency of home-cooked dinners and the main study outcome overweight/obesity was examined using a flexible model with dummy variables for each single dinner frequency category; the relationship was clearly nonlinear, so cooking could not be modeled as a continuous variable. Because the majority of participants (54%) reported 7 home-cooked dinners/wk, categorization was necessary based on sample size among SNAP recipients and income-eligible non-recipients reporting <7 dinners/wk, as described previously [7, 27, 38]. To determine appropriate categorization, cooking frequencies were grouped together if there was no difference in prevalence of overweight/obesity. Thus, home-cooked dinners were categorized into a binary variable for 0-6 home-cooked dinners/ week vs. 7 home-cooked dinners/week ("daily home-cooked dinner"). To determine whether results were robust to alternate categorization, sensitivity analyses were conducted with frequency of dinners cooked at home categorized as 0-3, 4-6, or 7 home-cooked dinners/wk.

Outcome assessment

Dietary outcomes—One day of 24-hour dietary recall, which was collected by trained interviewers using the USDA's Automated Multiple-Pass Methodology was used, as recommended by NHANES analytic guidelines.[39, 40] Energy (kcal) and weight (grams) for each reported food or beverage was derived from the USDA's Food and Nutrient Database for Dietary Studies, versions 4.1 (2007-2008) and 5.0 (2009-2010).[41] Solid fat and added sugar (SoFAS) were determined from the Food Patterns Equivalents Database for the corresponding survey cycle.[42, 43] Energy density was calculated as kcal/g.

All foods and beverages were aggregated into 55 mutually exclusive food and beverage groups based on nutritional content and dietary behaviors as described elsewhere.[44, 45] This analysis examined daily energy intake from key food groups, including total fruit (excluding juice), non-starchy vegetables, and SSBs (including soda and fruit drinks), which have been previously associated with poor dietary intake, weight gain, or obesity.[46-49] Additional dietary variables were derived from the Diet, Behavior, and Nutrition questionnaire, including the number of meals purchased from a fast food restaurant and the frequency of frozen meals/frozen pizzas eaten in the past 7 days.

Anthropometric measurements—Weight and height were measured by trained health technicians.[50, 51] Overweight/obesity was defined as body mass index (BMI) ≥ 25.0 kg/m^2. [52]

Covariates—Sociodemographic information was collected by interviewer-administered questionnaires to assess the participant's age, gender, race/ethnicity, education, family income, and marital status. Physical activity was assessed using a Global Physical Activity Questionnaire that evaluated weekly frequency and duration of moderate and vigorous work, recreational, and transportation activity. Total moderate and vigorous activity was converted to METs using scores recommended in NHANES analytic guidelines.[53, 54]

All SNAP-eligible (family income ≤130% FPL) adults aged 19-65 y with 1 dietary recall data deemed reliable by study administrators were eligible for inclusion (n=2,696 after exclusion of 44 pregnant women). Adults with incomplete data for weekly frequency of cooked dinners (n=18), BMI (n=38), education (n=1), physical activity (n=1), frequency of fast food meals (n=9), or marital status (n=51) were excluded (final analytic sample n=2,578).

Statistical Analysis

All analyses were conducted in 2016 using survey commands in Stata 14 (College Station, TX) to incorporate survey weights and account for complex survey design. To describe the study population, the survey-weighted unadjusted mean frequency of home-cooked dinners and distributions of sociodemographic characteristics were compared for participants reporting 0-6 vs 7 home-cooked dinners/week using t-tests and chi-square tests, respectively.

The primary hypothesis was that the relationship between daily home-cooked dinners and total dietary intake would be stronger among SNAP benefit recipients compared to income-eligible non-recipients. Thus, to examine the association between cooking and overall dietary intake outcomes, multivariable-adjusted survey weighted regression models were used to regress continuous dietary outcomes on frequency of eating dinners cooked at home, SNAP status, and the interaction of cooked dinners and SNAP status. Separate models were estimated for each dietary outcome. Continuous outcomes total daily energy intake (kcal/d); intake of SSBs, fruit, and vegetables (kcal/d); and the energy density of foods (kcal/g) were modeled using linear regression. Fractional probit models were used for the percent of energy intake from total SoFAS, solid fat, and added sugar (% kcal/d) to account for limited range of these proportional outcomes. Zero-inflated negative binomial models were used for the number of fast food meals per week and the number of frozen meals/frozen pizza in the past 30 days, after confirming over-dispersion and high frequency of non-consumers. Wald “chunk” tests of the cooking by SNAP interaction term were used to test whether the association between home-cooked dinner intake and dietary outcomes were significantly different for SNAP recipients vs income-eligible non-recipients. Using beta coefficients from the fully adjusted models, Stata's margins commands were used to predict adjusted mean dietary intakes and calculate the conditional marginal effect of daily home-cooked dinners on total diet by SNAP status.

To examine the hypothesis that fast food intake confounds the association between cooking and diet, models additionally adjusted for fast food intake and the interaction of fast food intake with SNAP benefit status. Categorization of fast food meal frequency was determined by using dummy variables for each count frequency to examine the shape of the nonlinear relationship between fast food intake and overweight/obesity, then collapsing based on

homogeneous risk across categories and sample size. Thus, frequency of fast food intake was represented as a binary variable distinguishing consumers vs non-consumers (1+ vs 0 meals/week). Sensitivity analyses alternately categorized fast food intake as 0, 1, 2, or 3+ meals/week to determine whether results were robust to categorization.

To examine the association between daily home-cooked dinners and overweight/obesity, survey-weighted logistic regression models were used to regress overweight/obesity on frequency of home-cooked dinners, SNAP status, and the interaction of home-cooked dinners and SNAP status. To test the hypothesis that these associations between daily cooking and overweight/obesity are confounded by fast food intake, models were additionally adjusted for frequency of fast food intake and the interaction of fast food intake and SNAP status. Beta coefficients from the fully adjusted models were used to predict and compare the prevalence of overweight/obesity by SNAP status and frequency of home-cooked dinners, with and without adjustment for fast food intake, as well as to predict the prevalence of overweight/obesity by SNAP status and fast food intake. Wald interaction tests were used to evaluate whether associations of home cooking or fast food intake with overweight/obesity were significantly different for SNAP recipients vs income-eligible non-recipients. To ensure that results were robust to dichotomization of BMI, analyses were repeated using multinomial logistic regression with weight status as the outcome, defined as underweight (BMI<18.5), normal weight (BMI 18.5-24.9, referent outcome), overweight (BMI 25.0-29.9), and obese (BMI≥30.0).

All models were adjusted for age (age and age squared), gender, race/ethnicity (Non-Hispanic white, non-Hispanic black, Mexican American, and Other), education (< high school, high school, some college, and college degree or higher), quartiles of family income as a percentage of the FPL, survey year (2007-2008 or 2009-2010), marital status (never married, widowed/divorced/separated, married/living with partner), and physical activity (quartiles of total MET-min/week of physical activity). Significance for interactions was set at α=0.1; for all other analyses, 2-tailed *P*-values<0.05 were considered statistically significant.

Results

Adults who reported daily home-cooked dinners were more likely to be >30y, Mexican American, and less-educated (Table 1).

Among SNAP recipients, daily home-cooked dinner was not associated with total energy intake relative to those reporting home-cooked dinner <7 times/week (Table 2). Daily home-cooked dinner was associated with lower SoFAS (-3.0%) and solid fat (-1.6%) intakes and lower energy density (-0.20 kcal/g). Daily home-cooked dinner was also associated with lower SSB intake (-54 kcal/d) as well as fewer fast food meals and frozen meals/pizza (-1.0 meals/week and -1.9 meals/30 d, respectively). Differences in these associations between SNAP and eligible non-recipients were detected, as daily home-cooked dinner was not associated with lower solid fat intake (*P*-interaction=0.2) or energy density (*P*-interaction=0.05) among non-recipients.

With regards to nutrition outcomes, adjusting for fast food intake had only minor effects on the magnitude of associations, with a tendency towards attenuation. In addition, the interaction of cooking and SNAP participation became statistically significant for solid fat intake; daily home-cooked dinners were associated with lower solid fat intake (-1.6% kcal) among SNAP recipients but not among non-recipients (+0.2% kcal, *P*-interaction=0.05). The interaction also became significant for SSB intake; daily home-cooked dinners were associated with lower SSB intake (-49 kcal/d) among SNAP recipients but not among non-recipients (-7 kcal/d, *P*-interaction=0.08). Results were robust in sensitivity analyses with more granular categorization of cooking and fast food meal frequencies (Supplemental Table 2). SNAP recipients with either 0-3 or 4-6 home-cooked dinners/wk had higher SoFAS, solid fat, and SSB intakes; higher energy density; and more frequent consumption of fast food meals and frozen meals/frozen pizza compared with SNAP recipients reporting daily home-cooked dinner.

Among SNAP recipients, daily home-cooked dinner was associated with 6% lower overweight/obesity prevalence (Table 3), while among eligible non-recipients, daily home-cooked dinner was not associated with overweight/obesity (p=0.07 for interaction). The association between home cooking and overweight/obesity among SNAP recipients was attenuated after adjustment for fast food intake and was no longer statistically significant. However, eating at least one fast food meal per week was associated with 9.3% and 11.6% higher prevalence of overweight/obesity among SNAP recipients and income-eligible non-recipients, respectively. In supplemental analyses, daily home-cooked dinners were associated with higher prevalence of normal weight among SNAP recipients, but not overweight or obesity (Supplemental Table 4). Fast food intake was associated with significantly higher prevalence of obesity among both SNAP recipients and non-recipients.

Sensitivity analyses confirmed that daily home-cooked dinner was associated with lower prevalence of overweight/obesity compared with either 0-3 or 4-6 home-cooked dinners/wk among SNAP recipients and that daily home-cooking was not associated with lower overweight/obesity prevalence among income-eligible non-recipients (Supplemental Table 3). After adjustment for fast food intake, cooking was not significantly associated with weight status among any low-income adults. Consuming either 1, 2, or 3+ fast food meals/wk was associated with higher prevalence of overweight/obesity compared with 0 fast food meals/wk.

Discussion

Daily home-cooked dinners were associated with improvements in some but not all dietary outcomes, including reductions in SoFAS and SSB intakes and lower energy density. Improvements in dietary intake tended to be larger and more often statistically significant for SNAP recipients than for eligible non-recipients. One explanation is that SNAP participants have more money to spend on food, and thus perhaps can purchase healthier ingredients, leading to healthier home-cooking. On the other hand, SNAP participants can used money saved on groceries to purchase more fast food, among other things, [28, 55]—and we did observe that SNAP recipients consumed more fast food. Thus, the cooking-diet association, which persisted even after controlling for fast food, could simply represent an issue of

choice: SNAP households that choose to cook, despite increased funds to purchase convenience food (in the form of fast food or ready-to-eat foods), tend to eat more healthfully. An additional possibility is that SNAP recipients respond to educational messages received in the SNAP-Ed program, although this seems unlikely given the heterogeneity of this program across states, with only some including a cooking component.[56, 57] A final possibility is that the stronger associations between cooking and diet among SNAP participants may be due to selectivity of who chooses to participate in SNAP: those who choose to participate may be more concerned about health or nutrition and thus more likely to cook; or, if they do cook, they may be more likely to cook healthfully.

It was interesting that while daily home-cooked dinners were associated with small improvements in dietary intake, 0-3 and 4-6 home-cooked dinners/week were not. This suggests that SNAP participants may need to cook dinner daily in order to achieve diet benefits; however, more research is needed to understand the frequency and type of cooking needed to improve diet.

We also observed that daily home-cooked dinners were associated with a 6% decreased prevalence of overweight/obesity for SNAP but not non-SNAP recipients, but that this association was attenuated and no longer statistically significant after controlling for fast food intake. The attenuation of associations of cooking with diet and obesity after controlling for fast food suggest that at least part of the observed association between home cooking and improved diet or health outcomes may be through reduced fast food intake, not necessarily more home cooking. A more effective approach to improving diet and weight status could entail additional emphasis on reducing fast food intake, although this requires testing with an experimental approach before drawing conclusions.

Limitations

Because this analysis is cross-sectional, we cannot say whether cooking is causally associated with improved dietary intake and weight status. In addition, SNAP participation tends to be under-reported[58], which could bias the cooking-diet association, especially if there are dietary differences between those who accurately report participation status and those who do not. Reliance on self-reported dietary intake outcomes is another limitation, as overweight/obese adults are more likely to underreport total energy intake and less-healthful foods.[59, 60]

One challenge in studies of cooking, diet, and health is defining cooking: what constitutes cooking for one person may not for another (i.e. heating up a frozen pizza, chopping vegetables for a salad)[15]. More detailed questions on cooking methods in the questionnaire or 24-h recall would have enabled identification of which items had been home-cooked vs. pre-prepared (for example, “lasagna” could be made from raw ingredients (i.e. tomatoes, homemade pasta), assembled from pre-prepared ingredients (i.e. tomato sauce, dried pasta), or frozen and ready-to-heat). Participants do not report the frequency of eating home-cooked dinners, which might be higher than the frequency of cooking if participants cook large meals and eat home-cooked leftovers on subsequent days. In addition, the questionnaire probed on home-cooked dinners only; whereas fast-food frequency was based on intake at any meal, not only dinner. Ideally, future work would more carefully define and identify

levels of convenience, processing, and home food preparation across all eating occasions in order to understand the role these play in nutritional intake. Unfortunately, the questionnaire that assessed cooking behaviors was discontinued in 2011; thus, analyses were limited to data from 2007-2010 and could not examine more recent NHANES data.

Conclusion

In this study, daily home-cooked dinners were associated with small improvements in dietary intake and lower obesity prevalence for SNAP recipients but not eligible non-recipients; however, both the dietary and overweight/obesity associations were reduced when fast food intake was controlled for. More research is needed to understand the casual mechanism between home-cooking, reduced fast food intake, and dietary intake, and how these may improve diet quality in SNAP.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

We thank the National Institutes of Health and Carolina Population Center for support (P2C HD050924). No funder had a role in any aspect of study design, analysis, interpretation, writing, or publication. The authors have no conflicts of interest to declare. This work has not been previously presented elsewhere. LST and JMP were equally responsible for the design, analysis, interpretation, and writing of this manuscript.

Funding source: We thank the National Institutes of Health and Carolina Population Center for support (P2C HD050924). No funder had a role in any aspect of study design, analysis, interpretation, writing, or publication.

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Table 1

Sociodemographic characteristics of low-income US adults by frequency of dinner cooked at home, NHANES 2007-2010[a]

		Weekly frequency of dinner cooked at home[b]		
Characteristic	**Overall**	**0-6 times/wk**	**7 times/wk**	***P*-value[c]**
n (%)	n= 2,578	1,174 (50.4%)	1,404 (49.6%)	
Dinners cooked at home consumed/wk, mean ± SE	5.3 ± 0.1	3.6 ± 0.10	7.0 ± 0.02	**<0.0001**
Age group, %				**<0.0001**
19-29 y	35.5%	42.4%	28.5%	
30-49 y	42.7%	36.4%	49.2%	
50-65 y	21.7%	21.3%	22.2%	
Gender, %				0.5
Male	44.2%	43.2%	45.2%	
Female	55.8%	56.8%	54.8%	
Race/ethnicity, %				**<0.0001**
Non-Hispanic white	48.8%	54.5%	43.1%	
Non-Hispanic black	17.8%	22.5%	13.2%	
Mexican American	17.9%	11.3%	24.6%	
Other	15.4%	11.7%	19.1%	
Education, %				**<0.0001**
< High school	38.8%	29.9%	47.9%	
High school	28.7%	29.4%	28.0%	
Some college	24.7%	30.9%	18.3%	
College degree	7.8%	9.8%	5.9%	
SNAP recipient, %				0.06
Did not receive SNAP benefits within past year	52.2%	56.1%	48.2%	
Received SNAP benefits within past year	47.8%	43.9%	51.8%	
Weight status, %				0.5
Underweight	2.9%	3.3%	2.4%	
Normal weight	29.4%	30.3%	28.4%	
Overweight	29.4%	29.5%	29.2%	
Obese	38.4%	36.9%	40.0%	
Physical activity, % in Q4 MET-minutes/wk[d]	25.2%	24.8%	25.6%	0.7

Note: Boldface indicates statistical significance ($p<0.05$)

[a] Data for n=2,578 low income (family income ≤130% FPL) adults aged 19-65 years from the National Health and Nutrition Examination Survey (NHANES) 2007-2010. All values account for complex survey design and weights. FPL, Federal Poverty Level; MET, metabolic equivalent; SNAP, Supplemental Nutrition Assistance Program.

[b] Assessed by questionnaire asking how many times you or someone in your family cooked food for dinner or supper at home in the past 7 days.

[c] Survey-weighted unadjusted means and proportions compared for 0-6 vs 7 cooked meals/wk using t tests and chi-square tests, respectively.

[d] Based on total minutes per week of moderate work, vigorous work, moderate recreational, vigorous recreational, and travel physical activity reported on the Global Physical Activity Questionnaire.

Table 2

Adjusted mean dietary intake by home-cooked dinner frequency among SNAP benefit recipients and income-eligible non-recipients[a]

	Unadjusted for Fast Food Mean ± SE[b]			Adjusted for Fast Food Mean ± SE[c]		
Dietary component	**No SNAP**	**SNAP**	***P* interaction cooking × SNAP**	**No SNAP**	**SNAP**	***P* interaction cooking × SNAP**
Total energy (kcal/d)			0.3			0.2
Dinners cooked at home 0-6 times/wk	2163 ± 73	2268 ± 62		2146 ± 71	2270 ± 67	
Dinners cooked at home 7 times/wk	2206 ± 59	2171 ± 66		2229 ± 58	2169 ± 70	
SoFAS (% kcal/d)			0.8			0.4
Dinners cooked at home 0-6 times/wk	32.0 ± 0.8	35.0 ± 0.6		31.4 ± 0.8	34.9 ± 0.6	
Dinners cooked at home 7 times/wk	**29.5 ± 1.2**	**32.0 ± 0.8**		30.1 ± 1.1	**32.1 ± 0.8**	
Added sugar (% kcal/d)			0.5			0.5
Dinners cooked at home 0-6 times/wk	16.5 ± 0.7	18.3 ± 0.6		16.2 ± 0.7	18.2 ± 0.6	
Dinners cooked at home 7 times/wk	**14.3 ± 0.8**	16.9 ± 0.9		14.6 ± 0.7	17.0 ± 0.8	
Solid fat (% kcal/d)			0.2			**0.05**
Dinners cooked at home 0-6 times/wk	15.4 ± 0.6	16.6 ± 0.4		15.1 ± 0.6	16.6 ± 0.4	
Dinners cooked at home 7 times/wk	15.0 ± 0.5	**14.9 ± 0.4**		15.3 ± 0.5	**14.9 ± 0.4**	
Energy density of foods (kcal/g)			**0.05**			**0.02**
Dinners cooked at home 0-6 times/wk	1.99 ± 0.04	2.17 ± 0.04		1.97 ± 0.04	2.16 ± 0.04	
Dinners cooked at home 7 times/wk	1.92 ± 0.04	**1.98 ± 0.04**		1.95 ± 0.03	**1.99 ± 0.03**	
SSBs (kcal/d)			0.2			**0.08**
Dinners cooked at home 0-6 times/wk	190 ± 16	252 ± 14		185 ± 14	249 ± 14	
Dinners cooked at home 7 times/wk	171 ± 11	**198 ± 19**		178 ± 11	**200 ± 17**	
Fruit (kcal/d)			0.4			0.8
Dinners cooked at home 0-6 times/wk	38 ± 5	37 ± 5		41 ± 5	39 ± 5	
Dinners cooked at home 7 times/wk	51 ± 6	44 ± 4		48 ± 5	43 ± 4	
Vegetables (kcal/d)			0.4			0.4
Dinners cooked at home 0-6 times/wk	27 ± 5	21 ± 4		28 ± 6	22 ± 5	
Dinners cooked at home 7 times/wk	25 ± 7	24 ± 8		24 ± 6	24 ± 8	
Fast food meals per week			0.95			-
Dinners cooked at home 0-6 times/wk	2.0 ± 0.2	2.3 ± 0.2		-	-	
Dinners cooked at home 7 times/wk	**1.1 ± 0.1**	**1.3 ± 0.1**		-	-	

	Unadjusted for Fast Food Mean ± SE[b]			Adjusted for Fast Food Mean ± SE[c]		
Dietary component	**No SNAP**	**SNAP**	***P* interaction cooking × SNAP**	**No SNAP**	**SNAP**	***P* interaction cooking × SNAP**
Frozen meals/frozen pizza per 30 days			0.5			0.6
Dinners cooked at home 0-6 times/wk	3.2 ± 0.4	4.7 ± 0.7		3.2 ± 0.4	4.5 ± 0.6	
Dinners cooked at home 7 times/wk	2.0 ± 0.4	**2.8 ± 0.3**		2.0 ± 0.4	**2.8 ± 0.4**	

Note: Boldface indicates statistically significant differences in adjusted mean dietary intake among adults with 0-6 vs 7 cooked dinners/wk ($p<0.05$) and statistically significant interactions between cooking and SNAP benefit status ($p<0.1$).

[a]Data for n=2578 low income (family income ≤130% FPL) adults aged 19-65 years from the National Health and Nutrition Examination Survey (NHANES) 2007-2010. All values account for complex survey design and weights. FPL, Federal Poverty Level; SNAP, Supplemental Nutrition Assistance Program; SoFAS, Solid fat and added sugar; SSB, sugar sweetened beverage

[b]Determined from survey weighted regression models regressing continuous dietary outcomes on frequency of dinners cooked at home (0-6 or 7 times/wk), SNAP benefit status, and the interaction of cooked dinners and SNAP benefit status, adjusted for age, gender, race/ethnicity, education, quartiles of family income as a % of the federal poverty level among adults with ≤130% FPL, survey year, marital status, and physical activity. Beta coefficients from the fully adjusted model were used to determine the predicted adjusted mean dietary intake by SNAP benefit status and frequency of dinners cooked at home. Linear regression models were used for the continuous outcomes total energy, SSB, fruit, and vegetable intake and energy density. Fractional probit regression models were used for the fractional (proportion) outcomes % kcal SoFAS, % kcal added sugar, and % kcal solid fat. Zero-inflated negative binomial regression models were used for the count outcomes frequency of fast food meals and frequency of frozen meals, after confirming overdispersion ($\alpha \neq 0$) and zero-inflation.

[c]Models additionally included frequency of fast food intake (0 or 1+ meals/wk) and the interaction of fast food intake and SNAP benefit status.

Table 3

Adjusted overweight/obesity prevalence by home-cooked dinner or fast food frequency among SNAP participants and non-participants[a]

	Prevalence ± SE[b]		Conditional marginal effect (95% CI)[c]		
Cooked dinner or fast food frequency	**No SNAP**	**SNAP**	**No SNAP**	**SNAP**	***P* interaction**
Dinners cooked at home not adjusted for fast food intake					
0-6 times/wk	70.8 ± 3.1	80.6 ± 2.3	Ref	Ref	Cook × SNAP: ***P*=0.07**
7 times/wk	72.2 ± 2.5	74.6 ± 2.5	1.4 (-5.6, 8.3)	**-6.0 (-11.1, -0.9)**	
Dinners cooked at home adjusted for fast food intake					
0-6 times/wk	69.8 ± 3.2	79.5 ± 2.3	Ref	Ref	Cook × SNAP: ***P*=0.08**
7 times/wk	73.7 ± 2.3	75.7 ± 2.6	3.8 (-3.3, 11.0)	-3.8 (-9.1, 1.5)	
Fast food meals adjusted for dinners cooked at home					
0 meals/wk	65.0 ± 3.9	72.2 ± 2.7	Ref	Ref	FF × SNAP: *P*=0.9
≥1 meals/wk	76.6 ± 2.0	81.5 ± 2.5	**11.6 (3.3, 19.9)**	**9.3 (2.9, 15.6)**	

Note: Boldface indicates statistically significant differences in adjusted mean overweight/obesity prevalence among adults with 0-6 vs 7 cooked dinners/wk ($p<0.05$) and statistically significant interactions ($p<0.1$).

[a] Data for n=2578 low income (family income ≤130% FPL) adults aged 19-65 years from the National Health and Nutrition Examination Survey (NHANES) 2007-2010. All values account for complex survey design and weights. FPL, Federal Poverty Level; SNAP, Supplemental Nutrition Assistance Program.

[b] Determined from survey weighted logistic regression models regressing overweight/obesity on frequency of dinners cooked at home (0-6 or 7 times/wk), SNAP benefit status, and the interaction of cooked dinners and SNAP benefit status, adjusted for age, gender, race/ethnicity, education, quartiles of family income as a % of the federal poverty level among adults with ≤130% FPL, survey year, marital status, and physical activity. Beta coefficients from the fully adjusted model were used to determine the predicted prevalence of overweight/obesity by SNAP benefit status and frequency of dinners cooked at home. Models additionally included frequency of fast food intake (0 or 1+ meals/wk) and the interaction of fast food intake and SNAP benefit status where indicated, and were used to determine the predicted prevalence of overweight/obesity by SNAP benefit status and frequency of fast food meals/wk.

[c] Beta coefficients from the fully adjusted model were used to determine the difference in prevalence of overweight/obesity among adults with 0-6 vs 7 cooked dinners/wk for SNAP recipients and income-eligible non-recipients (conditional marginal effect of eating dinners cooked at home) and the difference in prevalence of overweight/obesity among adults eating 0 vs 1+ fast food meals/wk for SNAP recipients and income-eligible non-recipients (conditional marginal effect of fast food meals).