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Frequency of consumption at fast-food restaurants is associated with dietary intake in overweight and obese women recruited from financially disadvantaged neighborhoods

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Abstract

Fast-food restaurants are more prevalent in lower income and predominately African American neighborhoods, where consumption of fast-food is also higher. In general populations, fast-food consumption is related to less healthy dietary intake. This cross-sectional study examined the hypotheses that greater fast-food consumption is associated with less healthy dietary intake and poorer diet quality in overweight and obese women (N=196, 25–51 years, 87% African American) recruited from financially disadvantaged Census tracts. Dietary intake and diet quality (Alternate Healthy Eating Index, AHEI) were assessed via three 24-hour dietary recalls. Linear regression models tested the association between fast-food consumption and each outcome (Model 1). Model 2 added sociodemographics and physical activity. Model 3 added total caloric intake. Fast-food consumption was significantly associated with total caloric intake; total intake of meat, grains, sweetened beverages, dairy, fiber, cholesterol, sodium, and added sugar; and percent of calories from total fat, saturated fat, and trans fatty acids. Statistically significant associations remained in Model 2 but most were not significant in Model 3. Fast-food consumption was not associated with diet quality (AHEI) in any model. In this at-risk sample, fast-food consumption was associated with more negative dietary practices. Significant associations generally disappeared when controlling for total caloric intake, suggesting that women who eat more fast-food have higher total caloric intakes as a result of increased consumption of unhealthy rather than healthy foods.

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Keywords

Diet; fast foods; African Americans; socioeconomic factors; human

1.0 Introduction

Healthy People 2020 goals are to achieve health equity, eliminate disparities, and improve the health of all groups [1]. Ethnic/racial minorities and persons of low socioeconomic status (SES) are two groups particularly affected by health disparities and the lack of health equity. Ethnic/racial minority status and low socioeconomic status, whether conceptualized at the individual or neighborhood level, are both associated with an increased risk of morbidity and mortality for numerous health conditions [2, 3]. African Americans and persons of lower socioeconomic status are more likely than other groups to have two or more cardiovascular disease risk factors [4], and these groups also have higher rates of hypertension [5], poorly controlled diabetes [6], and obesity [7]. They also exhibit low rates of meeting recommendations for fruit and vegetable intake [8] and, in some studies, poorer dietary profiles [9, 10]. Furthermore, among African American women, lower neighborhood SES has been associated with 10-year weight gain even after adjustment for individual-level variables [11].

Socioeconomic forces that shape health behaviors in underserved populations are increasingly of interest, and in particular, the role of the food environment. Energy-dense foods are often the lowest cost options available to consumers in low income neighborhoods; foods with added sugars and fats are more affordable than healthier diet options [12]. African American neighborhoods have less store space devoted to fresh and frozen fruits and vegetables than other neighborhoods, but similar space devoted to energy-dense snacks [13]. People in lower income and ethnic minority neighborhoods have greater access to fast-food restaurants and energy dense foods [14] and less access to supermarkets with fresh produce [15] relative to people in higher income and majority neighborhoods.

Higher frequency of fast-food consumption has been reported in African Americans [16, 17] and persons of lower socioeconomic status [10, 18, 19], and a growing body of literature shows that fast-food consumption is associated with poorer dietary habits. Studies have compared the diet composition of adults, based on dietary recalls, on days in which fast-food was consumed versus days it was not. These studies show poorer dietary parameters on fast-food consumption days, including higher total calories, total fat, saturated fat, carbohydrates, added sugar, protein, and non-diet carbonated beverages and lower fiber, vitamins and minerals, milk, non-starchy vegetables, and fruit intake [16, 18]. Other studies have used food frequency questionnaires or dietary screeners and more general questions about average or typical fast-food consumption with similar findings [17, 20, 21], including in African Americans [17, 22]. In addition to specific dietary parameters, studies have also found that more frequent fast-food consumption is associated with poorer overall dietary quality, as measured by eating indices [17, 23], as well as weight gain and poor metabolic health outcomes [17, 24–26].

Although there is evidence that fast-food consumption is related to dietary intake and quality, few studies have used 24-hour dietary recalls, the “gold standard” in the field, to assess diet. Furthermore, few studies have examined these associations in African Americans in general, and African American women in particular. This omission is striking given the extremely high rates of overweight and obesity in African American women [7]. Thus, our research fills a gap in the literature by examining how fast-food consumption is associated with both specific dietary intake as well as overall dietary quality in an

underserved, at-risk sample of women. Our research objectives were to: (a) report the frequency of fast-food consumption in a sample of primarily African American women recruited from disadvantaged neighborhoods using three 24-hour dietary recalls, (b) examine the associations between fast-food consumption and select dietary intake measures, and (c) examine the association between fast-food consumption and diet quality (using the Alternate Healthy Eating Index, AHEI). Using a cross-sectional study design, 24-hour dietary recalls, and self-reported consumption of fast-food, we tested the hypotheses that greater frequency of consumption of fast-food would be associated with less favorable dietary intake and with poorer dietary quality. The dietary intake variables we investigated were total calories consumed; servings/day of fruits, vegetables, total meat, lean meat, whole grains, total grains, sweetened beverages, total dairy, and low fat dairy; percent of calories from total fat, saturated fat, and trans fatty acids; and total fiber, cholesterol, sodium, and added sugar

2.0 Methods and Materials

2.1 Participants

Women were recruited to a weight loss trial [27] from 18 contiguous Census tracts in Columbia, SC in which at least 25% of residents were living in poverty. Study criteria were: (a) BMI ≥ 25 kg/m² (no upper limit) and waist circumference ≥ 88 centimeters; (b) 25 to 50 years of age at the time of screening; (c) English speaking; (d) not pregnant; (e) able to participate in some type of moderate-intensity exercise; (f) no positive (risk) response(s) on the Physical Activity Readiness Questionnaire (PAR-Q) [28] or physician approval on the subsequent Physical Activity Readiness Medical Examination (PAR-MED-X) [29] if a positive response was endorsed; (g) blood pressure $<140/90$ (unless written approval was provided by a health care provider); (h) no impairment(s) that would preclude participation in group discussion, learning activities or data collection interviews; and (i) did not have insulin-dependent diabetes. Eligible women who completed a baseline measurement visit were included in these analyses, regardless of whether or not they were ultimately randomized to a study group.

2.2 Procedures

The Sisters Taking Action for Real Success (STARS) trial is described in detail elsewhere [27]. In brief, STARS is a stratified (by body mass index [BMI]: ≥ 40 kg/m² vs. < 40 kg/m²) randomized trial. The primary aim is to test the effects of a 16-week behavioral and social support group-based intervention on body weight and waist circumference compared to a minimal intervention control group. The sample size was selected based on a power analysis to detect changes in primary and secondary study outcomes in the parent weight loss trial [27]. This paper uses data from the baseline measurement (baseline visits were conducted from 11/3/08-12/10/08, 10/5/09-12/8/09, and 10/4/10-12/1/10). All measurements described in this paper were taken prior to randomization. The study was approved by the University of South Carolina Institutional Review Board, and all participants completed an informed consent form.

2.3 Measurements

Dietary intake—Three, unannounced multiple-pass 24-hour recalls were conducted. Two days were weekdays and one day was a weekend day. During the baseline visit, participants received one-on-one training in estimating portion sizes. The training used the Food Portion Visual (The 2D Food Portion Visual, 1996, Nutrition Consulting Enterprises, Framingham, MA) [30] and food models, utensils, cups, bowls, and plates in a 20-minute session. This training was pretested during formative work to confirm its applicability to the study population. Directly after the portion size training, participants were taken to a private room and an off-site registered dietician trained in the Nutrient Data System for Research (NDSR)

protocol called and administered the first 24-hour recall via telephone. The remaining two calls were completed by telephone within the next 15 days. The average time between the first and third recall interviews was 9.5 days. The NDSR V2011 software was used for estimations. Interviewers were a team of experienced and trained master's level, registered dietitians. The average daily intake across the three interviews was computed. Twenty-four hour recalls have established validity and reliability [31].

For this study, dietary variables of interest from NDSR V2011 were average total calories consumed (kcal/day); servings/day of fruits, vegetables (minus potatoes), total meat, lean meat, whole grains, total grains, sweetened beverages, total dairy, and low fat dairy; percent of calories from total fat, saturated fat, and trans fatty acids; and total fiber (g/day), cholesterol (mg/day), sodium (mg/day), and added sugar (g/day) intake. Servings in NDSR V2011 are based on the 2005 Dietary Guidelines for Americans [32].

We also computed a diet quality index. Several diet quality indices exist [33–37]. We chose the AHEI [33] because it has been shown to have stronger associations with health outcomes than other indices [38, 39]. The original AHEI includes nine components. One of the components, duration of multivitamin use, was not available. The remaining eight components were included in this study and are listed in Table 1, along with scoring [33]. The total score could range from 0 to 80, with a higher score indicating a higher quality diet.

Fast-food frequency—During the baseline study visit, and prior to the completion of the 24-hour dietary recalls, the frequency of visits to fast-food restaurants in the past 7 days was assessed with a question from the Early Childhood Longitudinal Study [40], similar to measures used in other studies of fast-food consumption [10, 17, 21–23, 41]. Participants reported how often in the past 7 days they ate a meal or a snack from a fast-food restaurant (examples of fast-food restaurants were provided). Response options were ‘none,’ ‘1 or 2 times,’ ‘3 or 4 times,’ and ‘5 or more times.’

Anthropometrics—Weight was measured with a Seca 882 scale (Seca, Hanover, MD) to the nearest tenth of a pound. Height was measured with a Seca stadiometer (Seca, Hanover, MD) in inches to 2 decimal points. Height and weight were converted to metric units and BMI was computed as kilograms divided by squared meters (kg/m^2). A BMI of 25.0 to 29.9 was considered overweight. A BMI of ≥ 30.0 was considered obese.

Moderate- to vigorous-intensity physical activity (MVPA)—During the baseline visit, participants were instructed to wear an ActiGraph accelerometer (GT1M model, ActiGraph, LLC, Fort Walton Beach, FL) on their right hip during all waking hours for the subsequent seven consecutive days [42]. A 60-second epoch (time interval) was used. The GT1M model is the newer version of the extensively validated 7164 Model [43]. Consistent with other protocols and recommendations [44–46], women had to wear the accelerometer for at least 4 days and at least 10 hours per day for their data to be included in the analyses. Cutpoints defined by Lopes et al. [47] were used to classify activity counts as moderate- to vigorous-intensity ($3.0+$ METS; $1240+$ counts/minute). These cutpoints were validated for overweight and obese participants [47]. Percent of wear time spent in MVPA was computed.

Sociodemographic characteristics—Age, educational status, race, Hispanic ethnicity, employment status, and marital status, and number of children less than 18 years of age at home were assessed with self-report questions during the baseline visit.

2.4 Statistical Analyses

Analyses were conducted with SAS version 9.2 (Cary, NC). Three linear regression models were conducted for each dependent variable (dietary variables and AHEI). In Model 1, fast-food consumption was the only independent variable. Model 2 added covariates (age, education, employment status, marital status, MVPA). Because it was possible that consumption of key dietary variables was higher because of greater caloric intake, Model 3 added kcals/day to adjust for total calories consumed.

3.0 Results

As previously described [27], 746 phone inquiries were received for the study, 657 were reached for telephone screening, and 307 remained initially eligible and were scheduled for a baseline visit. Reasons for ineligibility were not residing in the targeted Census tracts (n=232), not in age range (n=59), logistic or scheduling conflict (n=23), not overweight (n=21), medical exclusions (n=12), and institutional residence with no food choice or cooking facility (n=3). A total of 230 participants signed informed consent forms, but 26 were excluded due to medical contraindications, 6 did not have sufficient accelerometer data, 1 did not complete the 24-hour dietary recalls, and 1 did not have accelerometer or dietary recall data, leaving a sample of 196 participants for this paper.

Characteristics of study participants are shown in Table 2. Participants averaged 38 ± 8 years of age. Most were African American (87%), with at least a high school education (95%), employed (78%), and either married/partnered (30%) or never married (41%). The most commonly reported health conditions were hypertension (30%), arthritis (14%), lung disease (12%), diabetes (11%), and heart disease (10%). Most participants (94%) fell in the obese category.

As compared to the 2010 Dietary Guidelines for Americans for women with comparable ages and caloric intakes (1,800 to 2,000 calories per day) [48], study participants consumed fewer servings of fruits, vegetables, and dairy than recommended. Fiber intake was far below recommendations, while sodium consumption was substantially above recommendations. Participants consumed somewhat more fat than recommended. Although total grain consumption was consistent with recommendations, the majority of grains consumed were refined. Participants consumed, on average, 2.2 ± 1.8 servings of sweetened beverages per day. Participants, on average, scored 29.9 ± 9.4 on the AHEI, which is below the midpoint (range: 0 to 80; multivitamin use not assessed), with mean component scores on fruit, vegetables, nuts and soy protein, cereal fiber, and alcohol (largely due to the fact that most women reported no or very low alcohol use) particularly low.

A total of 33 participants (17%) ate fast-food 0 times, 86 (44%) ate it 1 to 2 times, 47 (24%) ate it 3 to 4 times, and 30 (15%) ate it 5 or more times in the past 7 days. Fast-food consumption was significantly associated with age, $F(3,192) = 3.16$, $p = .03$. Participants who ate fast food 3 to 4 or 5 or more times per week were significantly younger than those who ate no fast-food in the past 7 days. Fast-food consumption was not associated with the number of children in the home, marital status, education, or employment status (data not shown).

Table 3 presents results from the three linear regression models (Model 1 = unadjusted model; Model 2 = adjusted for covariates; Model 3 = adjusted for covariates plus total caloric intake) for each outcome of interest. In the unadjusted models (Model 1), fast-food consumption was significantly associated with total caloric intake, total meat, total grains, sweetened beverages, total dairy, total fat, saturated fat, trans fatty acids, fiber, cholesterol, sodium, and added sugars. In general, those eating fast-food most frequently (5+ times in

past 7 days) had higher scores on these measures than those eating no fast-food, and in some cases, than those eating fast-food 1–2 times in the past 7 days. Fast-food consumption was not associated with fruit, vegetables, lean meat, whole grains, low fat dairy, or AHEI scores.

In Model 2, which added age, education, employment, marital status, and physical activity, all of the Model 1 associations remained statistically significant with the exception of sweetened beverages, although for that variable, the model approached statistical significance and the pattern was the same as in Model 1 ($p=.07$). Low fat dairy also emerged as significantly associated with fast-food consumption. Consumption was higher in those reporting no fast-food consumption as compared to those reporting it 5+ times.

In Model 3, which added total caloric intake, only one variable was statistically significant: low fat dairy consumption was significantly higher in those reporting no fast-food consumption as compared to those reporting it 5+ times. The explained variance increased appreciably from Model 2 to Model 3 for total meat, total grains, sweetened beverages, total dairy, total fiber, total cholesterol, total sodium, and added sugars, but it increased less so for fruit, vegetables, lean meat, whole grains, and low fat dairy (note that because we used percentage of calories, fat values were already essentially adjusted and thus Model 3 was not used for fat variables).

4.0 Discussion

The purpose of this study was to examine associations between frequency of fast-food consumption and dietary variables and overall diet quality in a sample of overweight and obese women recruited from financially disadvantaged neighborhoods. The women in our sample were at high risk for chronic disease-related morbidity and mortality. In support of our first hypothesis, our primary finding was that women who ate fast-food more frequently, especially those eating it five or more times in the past seven days, also consumed more overall calories; more servings per day of total meat, total grains, and sweetened beverages; higher levels of sodium and cholesterol; more total and saturated fat and trans fatty acids; fewer servings of low fat dairy; and more added sugars. These associations remained after controlling for sociodemographic variables and physical activity, and in the adjusted model, low fat dairy intake also emerged as significant. Low fat dairy consumption was higher in those reporting no fast-food consumption as compared to those reporting it five or more times in the past seven days.

Studies have shown that on days in which people ate fast-food (based on 24-hour recalls), their dietary intake was less favorable relative to days they did not eat fast-food [16, 18] and other studies found that average fast-food consumption was related to less healthy dietary intake (using food frequency questionnaires and questions about typical fast-food consumption) [17, 20–22]. Although our methodology differed from these studies, our findings were generally consistent with them. While studies have shown fruit and vegetable consumption to be lower on days in which individuals ate fast-food [16, 18], one study that targeted African Americans found that vegetable but not fruit intake was significantly and negatively associated with fast-food consumption [22], whereas another found no association between fast-food consumption and fruit, vegetable, or whole grain consumption [17]. The participants in our study had a very low intake of fruit (0.93 servings/day) and vegetables (2.41 servings/day total, 1.84 when potatoes were removed from the total), which may reflect issues of poor access to healthy foods as well as food preferences.

Most of the associations between fast-food consumption and dietary intake were no longer significant after controlling for total caloric intake, suggesting that the association between fast-food consumption and many of the negative dietary behaviors may be due in large part to increased caloric intake. Interestingly, when total caloric intake was added to the

regression models, it substantially increased the explained variance for some, but not all, dietary variables. For example, explained variance increased less markedly for fruit, vegetables, lean meat, whole grains, and low fat dairy as compared to total meat, total grains, sweetened beverages, total dairy, total cholesterol, total sodium, and added sugars. These findings suggest that the increase in total caloric intake is not due to increased consumption of healthier foods (with the exception of fiber), but instead due to increased consumption of less healthy foods.

Several other findings were noteworthy. First, frequency of fast-food consumption was high. In the previous seven days, most women had consumed fast-food, and 39% had consumed it three or more times. Studies have differed in their measurement of fast-food consumption, making direct comparisons difficult. In the Continuing Survey of Food in Individuals national survey [18], 37% reported fast-food consumption on a 24-hour recall, and the rate was higher in those aged 20–29 years (52%), 40–59 years (40.5%), and in African Americans (45.8%). In CARDIA, Black women reported eating fast-food an average of two times per week in 2000–2001 [17]. In the Multi-Ethnic Study of Atherosclerosis (MESA), 30.7% of Black participants reported never eating fast-food in an average week, 34.4% reported eating fast-food less than once a week, and 34.9% reported eating fast-food one or more times per week [23].

Consistent with other studies [16, 18, 23], we found that participants who ate fast-food more frequently (2–3 or 5+ times in past 7 days) were younger than participants who reported no fast-food consumption in the past 7 days. We found no associations between the number of children living at home, marital status, education level or employment status and fast-food consumption. Perhaps this lack of association was due to the restricted range in socioeconomic status since all participants were recruited from financially disadvantaged neighborhoods.

Second, study participants were consuming, on average, a diet that placed them at increased risk for chronic disease. Fruit, vegetable, dairy, whole grain, and fiber consumption were below recommended levels, whereas fat, sodium, and sweetened beverage consumption were above recommended levels [48]. It is notable that women were consuming only 13 grams of fiber versus the 25 to 28 grams that are recommended. The high consumption of refined grains, and low consumption of whole grains, fruits, and vegetables help to explain this finding. Furthermore, sodium consumption averaged over 3,000 mg/day. Recommended levels for sodium consumption are less than 2,300 mg/day, and even lower for African Americans and those who have hypertension, diabetes, or chronic kidney disease (1,500 mg/day). Although dietary intake in these categories differed substantially from recommendations, they were closer to the actual dietary intake of American women, although somewhat less healthy in certain areas. For example, similarly aged women in NHANES reported consuming 1,794–1,831 kcals/day (vs. 1926 in our sample), 15.1–16.6 grams/day of fiber (vs. 13.2 in our sample), 3,014–3,050 mg/day of sodium (vs. 3195 in our sample), and 32–33% of calories from total fat (versus 35% in our sample) [49]. Dairy consumption was also found to be low among similarly aged women in NHANES; African American women reported 0.71–0.93 servings/day and women of other races reported 1.09–1.21 servings/day of dairy (vs. 1.14 in our sample) [50]. Higher lactose intolerance in African Americans could explain the lower values of dairy consumption. Whole grain consumption has also been shown to be low in the U.S. population; adults aged 19–50 in NHANES reported only 0.63 servings/day of whole grains (vs. 0.66 in our sample) [51]. Additionally, only 12.3% of women in NHANES met dietary recommendations for fruit and 18.6% for vegetables [52]. Mean intake was 0.61 cups/day of fruit and 1.42 cups/day of vegetables (vs. 0.92 and 2.4 servings/day in our sample, respectively, which is equivalent to 0.46 and 1.2 cups/day).

Based on this pattern of dietary intake, it is not surprising that participants scored low on the AHEI, a measure of overall diet quality, and its components. The mean AHEI score of 29.9 for our sample was lower than reported in many other studies of diet quality among women. We did not have data to compute the multivitamin scale, but if we assigned all women a score of 5 (midpoint), the mean score on the AHEI would have been 34.9. Three other reports, based on food frequency questionnaires, have reported that women in the middle quintile of AHEI score had median scores of 45.5 (Women's Health Initiative) [53], 44 (Nurses' Health Study 2002 data) [54], and 37.7 (Nurses' Health Study 1984, 1986, and 1990 data) [33]. These studies also found that women with AHEI scores in the lowest quintiles (similar to the mean AHEI in our study) were at increased risk for cardiovascular disease [33] and heart failure [53]. A small number of studies have reported AHEI scores in African Americans or in financially disadvantaged women. Mean scores from Black and White women enrolled in the Women's Health Initiative were 33.2 and 36.9, respectively [55]. In an analysis of financially disadvantaged women in NHANES (using one 24-hour dietary recall), participants enrolled in the Supplemental Nutrition Assistance Program (SNAP) scored significantly lower (21.1) than low-income adults who had not received SNAP benefits in the previous 12 months (24.6) [56]. Huffman et al [57] reported significantly higher AHEI scores in Haitian Americans (51.4) than in African Americans (42.4), with and without type 2 diabetes, based on a food frequency questionnaire (52% of participants were women). Finally, results from MESA indicated that Non-Hispanic Blacks and Hispanics were less likely to have a healthy diet than non-Hispanic whites, as defined by AHEI scores in the top quintile (using a food frequency questionnaire) [23, 58]. Mean or median values, however, were not reported.

Despite the associations between fast-food consumption and many dietary variables, our second hypothesis that fast-food consumption would be negatively associated with diet quality (assessed with the AHEI) was not supported. Our findings are not in line with those from two other studies in this regard. Moore et al [23] found that fast-food consumption was associated with a poorer diet quality (AHEI) in MESA. A study from Spain found similar associations using the Mediterranean diet score and the Healthy Eating Index [21].

This study had a number of strengths and extends the literature in several ways. We focused on a high risk, understudied population of overweight and obese women, who were predominantly African American, recruited from financially disadvantaged neighborhoods. We used three 24-hour dietary recalls to estimate dietary consumption. In addition to examining associations between fast-food consumption and individual dietary variables, we also attempted to quantify diet quality in a comprehensive manner by using the AHEI, and we examined associations between the AHEI and fast-food consumption. Nonetheless, the study also had some limitations that must be considered. First, and most importantly, the study is cross-sectional and thus causal inferences must be made with great caution. Relative to some other studies in this area, our sample size was small. However, the high-quality measures used in this study help to offset this limitation. Our inclusion of only women prevents the generalization of our findings to men. Finally, our focus on overweight and obese women from financially disadvantaged neighborhoods, while a strength in terms of public health need, also may limit the range of scores for some outcomes, thus potentially attenuating associations.

In summary, this study underscores the need for dietary interventions among overweight and obese women from financially disadvantaged neighborhood that address fast-food consumption and alternative choices. Our findings show that even among these high risk women, greater frequency of fast-food consumption was related to a host of less healthy dietary variables, even when controlling for sociodemographics and physical activity. Our results also suggest that greater caloric intake was associated with increased consumption of

less healthy foods, but not healthier foods. Dietary interventions should target, in particular, decreasing fat consumption, increasing the proportion of whole grains (relative to total grains), choosing lower-fat dairy options, reducing sodium, reducing the intake of sweetened beverages, and increasing fiber. Because fast-food is convenient, interventions aiming to decrease fast-food consumption should help women develop skills and knowledge to make home-cooked meals healthier. For example, meal planning and the use of recipes with relatively few ingredients and ingredients that can be made readily available (e.g., frozen vegetables) are two suggested strategies. Setting goals and tracking behavior specific to fast-food consumption might also be useful. For financially disadvantaged populations, emphasizing the cost per person of fast-food versus economical home-cooked meals might also be helpful. Finally, helping women identify healthier selections in fast-food settings may help to promote healthy dietary change. Our findings suggest that these strategies might be particularly useful for women who frequently visit fast-food restaurants.

An important next step in this general line of research is to examine whether interventions that successfully decrease fast-food consumption, particularly among heavy consumers, results in improved dietary intake and other health and disease parameters. This next step would help to establish a cause-and-effect relationship between fast food consumption, dietary intake, and health outcomes.

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Abbreviations

AHEI	Alternate Healthy Eating Index
BMI	Body Mass Index
NDSR	Nutrient Data System for Research
NDSR V2011	Nutrient Data System for Research, 2011 version
kcal	kilocalories
g	grams
mg	milligrams
MVPA	moderate- to vigorous-intensity physical activity
MESA	Multi-Ethnic Study of Atherosclerosis

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Table 1

Scoring for the Alternate Healthy Eating Index (AHEI)

AHEI Component	Criteria for minimum score	Criteria for maximum score	Notes
Vegetables, servings/day	0	5	Potatoes are not included in total.
Fruit, servings/day	0	4	
Nuts and soy protein, servings/day	0	1	
Ratio of white to red meat	0	4	Vegetarians and those consuming red meat < 2 times/month received the maximum score.
Cereal fiber, grams/day	0	15	
<i>trans</i> Fat, % energy	4	0.5	
Ratio of polyunsaturated to saturated fatty acids	0.1	1	
Duration of multivitamin use	< 5 years	5 years	This component was not assessed in our study. Scoring would be 2.5 for minimum and 7.5 for maximum.
Alcohol, servings/day	0 or > 2.5	0.5 – 1.5	These values are for women and include beer, wine, and liquor.
Total score, range	2.5	87.5	This range represents scoring for all components.
Total score with multivitamin use excluded, range	0	80	This range excludes multivitamin use.

Note: For all components except duration of multivitamin use, the minimum score is 0 and the maximum score is 10. Intermediate intakes were scored proportionately between 0 and 10, as recommended by McCullough [1].

Table 2

Sociodemographic, health-related, and dietary characteristics of study participants (N=196)

Characteristic	Percentage
Race	
White	8.16
Black or African American	86.73
Biracial	2.04
Hawaiian/Pacific Islander	0.51
Other	2.04
Not reported	0.51
Hispanic / Latino ethnicity	
Yes	3.06
No	96.43
Not reported	0.51
Educational attainment	
Grade 1–8	0.51
% Grade 9–11	4.08
High school graduate or GED	15.82
Some college or technical school	48.98
College graduate	30.61
Employment status	
Employed or self-employed	73.98
Not employed outside home	13.78
Student	4.59
Employed & student	3.57
Retired	1.02
Unable to work	3.06
Marital status	
Married, living together	20.92
Unmarried, living with partner	9.18
Separated	8.67
Divorced	18.37

Characteristic	Percentage
Widowed	1.53
Never married	41.33
Number of dependents in household	
Zero	46.43
One	21.94
Two	17.35
Three	10.20
Four or more	4.08
Self-reported health conditions (past or present)	
Hypertension	30.10
Arthritis	14.29
Diabetes	10.71
Lung disease	12.24
Heart disease	9.69
Cancer	1.53
Stroke	0.51
Kidney disease	0.00
Peripheral artery disease	0.00
Weight status	
Overweight	5.61
Obese	94.39
Fast-food consumption in past 7 days	
0 times	16.84
1–2 times	43.88
3–4 times	23.98
5 or more times	15.31

Characteristic	Mean (SD)	Range
Age, years	38.27 (7.57)	25 – 51
Height, inches	64.57 (2.45)	58.75 – 71.38
Weight, pounds	241.47 (57.90)	143.80 – 401.50
Body mass index, kg/m ²	40.56 (8.80)	26.95 – 69.45

Characteristic	Mean (SD)	Range
Time spent in moderate- to vigorous-intensity physical activity, %	5.15 (2.19)	0.81 – 19.14
Dietary variables:		
Kcals/d	1926.45 (767.49)	644.47 – 7173.83
Fruit, svg/d	0.92 (1.01)	0 – 4.85
Vegetables, svg /d	2.40 (1.39)	0 – 7.46
Vegetables minus potatoes, svg/d	1.84 (1.24)	0 – 7.25
Total meat, svg /d	5.26 (2.76)	0 – 19.67
Lean meat, svg /d	2.41 (1.95)	0 – 10.31
Total grains, svg /d	5.82 (2.88)	1.02 – 19.79
Whole grains, svg /d	0.66 (0.99)	0 – 4.94
Sweetened beverages, svg /d	2.23 (1.77)	0 – 9.58
Total dairy, svg /d	1.14 (0.95)	0 – 5.38
Low fat dairy, svg /d	0.13 (0.27)	0 – 1.67
kcal from total fat, %	34.97 (6.09)	18.80 – 55.60
kcal from saturated fat, %	11.18 (2.63)	5.09 – 22.01
kcal from trans fatty acids, %	2.17 (1.04)	0.32 – 6.13
Total fiber, g/d	13.18 (6.45)	3.01 – 37.70
Total cholesterol, mg/d	269.32 (145.99)	37.73 – 844.34
Total sodium, mg/d	3195.52 (1256.35)	984.62 – 8003.36
Added sugars, g/d	93.75 (67.18)	0.78 – 665.84
* AHEI Total Score	29.88 (9.35)	10.39 – 57.92
** AHEI Components:		
Fruit	2.30 (2.46)	0 – 10
Vegetable	3.62 (2.33)	0 – 10
Nuts and soy protein	2.30 (3.74)	0 – 10
White meat : red meat	4.57 (3.57)	0 – 10
Cereal (grain) fiber	3.34 (2.07)	0.67 – 10
Trans fatty acids	5.52 (2.59)	0 – 10
Polysaturated : saturated fat	7.29 (2.23)	2.20 – 10
Alcohol	0.95 (2.48)	0 – 10

* Total scores can range from 0 to 80, higher scores indicate a more favorable diet. Multivitamin use was not assessed, so total scores cannot be directly compared to other studies that assess all components.

** Component scores can range from 0 to 10, higher scores indicate a more favorable diet.

Note: Serving sizes are defined based on the 2005 Dietary Guidelines for Americans [2] and as described in the NDSR manual. Fruit servings are defined as 1 medium apple, banana, orange or pear, ½ cup of chopped, cooked or canned fruit, ¼ cup of dried fruit or ½ cup of fruit juice. Vegetable servings are defined as 1 cup of raw leafy vegetables, ½ cup of other cooked or raw vegetables, or ½ cup of vegetable juice. Meat servings are defined as one-ounce equivalents. Grains servings are defined as 1 slice of bread, 1 ounce of ready-to-eat cereal, or ½ cup of cooked cereal, rice or pasta. Dairy servings are defined as approximately equivalent to the amount of calcium in 1 cup of milk or yogurt, 1½ ounces of natural cheese, or 2 ounces of processed cheese.

Table 3

Associations between fast-food consumption (times eaten in the past 7 days) and dietary variables, adjusted and unadjusted models

	Model 1		Model 2		Model 3	
	Fast-food F (p), Model R ²	Mean (SE)	Fast-food F (p), Model R ²	Mean (SE)	Fast-food F (p), Model R ²	Mean (SE)
Kcals/d	F = 9.63 (p<.0001), R ² = .13		F = 7.77 (p<.0001), R ² = .15			n/a
0 times		1740.53 (125.53) _{a,c}		1795.19 (138.23) _a		
1 to 2 times		1708.48 (77.76) _{a,c}		1719.44 (91.70) _a		
3 to 4 times		2129.01 (105.19) _{a,b}		2115.52 (113.21) _{a,b}		
5+ times		2438.48 (131.66) _b		2411.88 (141.77) _b		
Fruit, svg/d	F = 1.58 (p = .19), R ² = 0.02		F = 1.56 (p = .20), R ² = .08		F = 1.55 (p = .20), R ² = .08	
0 times		1.20 (0.17)		1.14 (0.19)		1.16 (0.19)
1 to 2 times		0.84 (0.11)		0.78 (0.12)		0.81 (0.13)
3 to 4 times		1.01 (0.15)		0.96 (0.15)		0.98 (0.16)
5+ times		0.71 (0.18)		0.66 (0.19)		0.68 (0.20)
Vegetables minus potatoes, svg/d	F = 0.35 (p = .79), R ² = .01		F = 0.58 (p = .63), R ² = .05		F = 0.07 (p = .97), R ² = .13	
0 times		1.86 (0.22)		1.69 (0.24)		1.74 (0.23)
1 to 2 times		1.74 (0.13)		1.61 (0.16)		1.69 (0.16)
3 to 4 times		1.93 (0.18)		1.86 (0.192)		1.75 (0.19)
5+ times		1.94 (0.23)		1.88 (0.24)		1.63 (0.25)
Total meat, svg/d	F = 3.28 (p = .02), R ² = .05		F = 2.64 (p = .05), R ² = .09		F = 0.61 (p = .61), R ² = .27	
0 times		4.44 (0.47) _a		4.82 (0.51) _a		5.07 (0.46)
1 to 2 times		4.97 (0.29) _{a,b}		5.31 (0.34) _{a,b}		5.68 (0.33)
3 to 4 times		5.65 (0.40) _{a,b}		5.88 (0.42) _{a,b}		5.60 (0.40)
5+ times		6.36 (0.50) _b		6.64 (0.53) _b		5.89 (0.50)
Lean meat, svg/d	F = 1.43 (p = .23), R ² = .02		F = 1.46 (p = .23), R ² = .06		F = 0.91 (p = .44), R ² = .14	
0 times		2.45 (0.34)		2.66 (0.37)		2.83 (0.35)
1 to 2 times		2.27 (0.21)		2.54 (0.24)		2.78 (0.25)
3 to 4 times		2.22 (0.28)		2.43 (0.30)		2.35 (0.30)
5+ times		3.06 (0.35)		3.32 (0.38)		3.00 (0.38)
Total Grains, svg/d	F = 4.92 (p = .003), R ² = .07		F = 3.72 (p = .01), R ² = .10		F = 0.85 (p = .47), R ² = .62	

	Model 1 Fast-food F (p), Model R ² Mean (SE)	Model 2 Fast-food F (p), Model R ² Mean (SE)	Model 3 Fast-food F (p), Model R ² Mean (SE)
0 times	4.95 (0.49) _a	4.85 (0.53) _a	5.31 (0.35)
1 to 2 times	5.41 (0.30) _a	5.15 (0.35) _a	5.83 (0.25)
3 to 4 times	6.20 (0.41) _{ab}	5.90 (0.44) _{ab}	5.42 (0.30)
5+ times	7.34 (0.51) _b	6.95 (0.55) _b	5.60 (0.38)
Whole Grains, svg/d	F = 0.38 (p = .77), R ² = .01	F = 0.34 (p = .79), R ² = .06	F = 1.04 (p = .38), R ² = .09
0 times	0.75 (0.17)	0.72 (0.19)	0.67 (0.18)
1 to 2 times	0.69 (0.11)	0.66 (0.12)	0.63 (0.13)
3 to 4 times	0.62 (0.14)	0.59 (0.15)	0.47 (0.16)
5+ times	0.51 (0.18)	0.48 (0.19)	0.28 (0.20)
Sweetened Beverages, svg/d	F = 3.73 (p = .01), R ² = .06	F = 2.45 (p = .07), R ² = .16	F = 0.55 (p = .65), R ² = .26
0 times	1.83 (0.30) _a	2.12 (0.32)	2.30 (0.30)
1 to 2 times	1.92 (0.19) _a	2.05 (0.21)	2.29 (0.21)
3 to 4 times	2.71 (0.25) _a	2.73 (0.26)	2.65 (0.26)
5+ times	2.79 (0.32) _a	2.78 (0.33)	2.46 (0.32)
Total Dairy, svg/d	F = 3.45 (p = .02), R ² = .05	F = 3.60 (p = .01), R ² = .06	F = 2.06 (p = .11), R ² = .18
0 times	1.35 (0.16) _a	1.39 (0.18) _a	1.36 (0.17)
1 to 2 times	0.90 (0.10) _a	0.90 (0.12) _a	0.91 (0.12)
3 to 4 times	1.27 (0.14) _a	1.27 (0.15) _a	1.10 (0.14)
5+ times	1.39 (0.17) _a	1.39 (0.18) _a	1.09 (0.18)
Low Fat Dairy, svg/d	F = 2.51 (p = .06), R ² = .04	F = 2.62 (p = .05), R ² = .09	F = 2.86 (p = .04), R ² = .10
0 times	0.24 (0.05)	0.20 (0.05) _a	0.18 (0.05) _a
1 to 2 times	0.11 (0.03)	0.07 (0.03) _{ab}	0.05 (0.04) _{ab}
3 to 4 times	0.13 (0.04)	0.10 (0.04) _{ab}	0.07 (0.04) _{ab}
5+ times	0.07 (0.05)	0.03 (0.05) _b	-0.01 (0.05) _b
kcal from total fat, %	F = 3.85 (p = .01), R ² = .06	F = 4.52 (p = .004), R ² = .08	n/a
0 times	32.73 (1.04) _a	32.56 (1.14) _a	
1 to 2 times	34.54 (0.64) _{ab}	34.79 (0.76) _a	
3 to 4 times	35.65 (0.87) _{ab}	36.01 (0.93) _{ab}	

	Model 1		Model 2		Model 3	
	Fast-food F (p), Model R ² Mean (SE)	Fast-food F (p), Model R ² Mean (SE)	Fast-food F (p), Model R ² Mean (SE)	Fast-food F (p), Model R ² Mean (SE)	Fast-food F (p), Model R ² Mean (SE)	Fast-food F (p), Model R ² Mean (SE)
5+ times	37.60 (1.09) _b	38.17 (1.17) _b				
kcal from saturated fat, %	F = 2.63 (p = .05), R ² = .04	F = 2.71 (p = .047), R ² = .05				n/a
0 times	10.40 (0.45) _a	10.37 (0.50) _a				
1 to 2 times	11.00 (0.28) _{a,b}	11.08 (0.33) _{a,b}				
3 to 4 times	11.44 (0.38) _{a,b}	11.52 (0.41) _{a,b}				
5+ times	12.13 (0.47) _b	12.26 (0.51) _b				
kcal from trans fatty acids, %	F = 4.06 (p = .008), R ² = .06	F = 3.62 (p = .01), R ² = .07				n/a
0 times	1.65 (0.18) _a	1.64 (0.20) _a				
1 to 2 times	2.27 (0.11) _b	2.26 (0.13) _a				
3 to 4 times	2.15 (0.15) _{a,b}	2.14 (0.16) _{a,b}				
5+ times	2.48 (0.19) _b	2.46 (0.20) _b				
Total fiber, g/d	F = 3.17 (p = .02), R ² = .05	F = 3.63 (p = .01), R ² = .13				F = 0.93 (p = .43), R ² = .43
0 times	13.76 (1.10) _{a,b}	13.39 (1.17) _{a,b}				13.56 (0.96)
1 to 2 times	11.69 (0.68) _a	11.28 (0.78) _a				11.82 (0.68)
3 to 4 times	14.12 (0.92) _{a,b}	13.87 (0.96) _{a,b}				12.46 (0.82)
5+ times	15.33 (1.16) _b	15.07 (1.20) _b				12.20 (1.03)
Total cholesterol, mg/day	F = 3.72 (p = .01), R ² = .05	F = 2.86 (p = .04), R ² = .10				F = 0.15 (p = .93), R ² = .40
0 times	252.27 (24.90) _{a,b}	263.31 (27.07) _a				290.07 (22.21)
1 to 2 times	238.96 (15.42) _a	247.21 (17.96) _a				282.56 (15.68)
3 to 4 times	302.11 (20.86) _{a,b}	304.26 (22.17) _a				294.71 (18.95)
5+ times	323.72 (26.11) _b	323.57 (27.76) _a				280.42 (23.98)
Total sodium, mg/day	F = 9.84 (p < .0001), R ² = .13	F = 7.38 (p < .001), R ² = .15				F = 1.25 (p = .29), R ² = .71
0 times	2752.25 (205.20) _a	2870.71 (225.19) _a				3020.62 (132.47)
1 to 2 times	2912.06 (127.11) _{a,d}	2929.77 (149.39) _a				3179.81 (93.53)
3 to 4 times	3447.01 (171.94) _{c,d}	3416.72 (184.44) _{a,b}				3143.17 (113.02)
5+ times	4101.73 (215.21) _{b,c}	4039.20 (230.97) _b				3373.90 (142.98)
Added sugars, g/d	F = 4.41 (p = .005), R ² = .06	F = 3.03 (p = .03), R ² = .11				F = 0.55 (p = .65), R ² = .63

	Model 1 Fast-food F (p), Model R ² Mean (SE)	Model 2 Fast-food F (p), Model R ² Mean (SE)	Model 3 Fast-food F (p), Model R ² Mean (SE)
0 times	77.56 (11.40) _a	84.49 (12.37) _{a,b}	96.40 (7.99)
1 to 2 times	82.76 (7.06) _a	84.94 (8.21) _a	102.04 (5.64)
3 to 4 times	104.21 (9.55) _{a,b}	103.15 (10.13) _{a,b}	93.06 (6.82)
5+ times	126.71 (11.96) _b	124.16 (12.69) _b	93.72 (8.62)
* Alternate Healthy Eating Index	F = 1.75 (p = .16), R ² = .03	F = 1.71 (p = .17), R ² = .09	F = 1.89 (p = .13), R ² = .12
0 times	32.60 (1.62)	31.64 (1.74)	31.38 (1.72)
1 to 2 times	28.80 (1.00)	27.94 (1.15)	27.86 (1.21)
3 to 4 times	30.87 (1.36)	30.39 (1.42)	29.35 (1.46)
5+ times	28.42 (1.70)	28.04 (1.78)	26.28 (1.85)

* Multivitamin use was not assessed, so total scores cannot be directly compared to other studies that assess all components.

Note: Serving sizes are defined based on the 2005 Dietary Guidelines for Americans [2] and as described in the NDSR manual. Fruit servings are defined as 1 medium apple, banana, orange or pear, ½ cup of chopped, cooked or canned fruit, ¼ cup of dried fruit or ½ cup of fruit juice. Vegetable servings are defined as 1 cup of raw leafy vegetables, ½ cup of other cooked or raw vegetables, or ½ cup of vegetable juice. Meat servings are defined as one-ounce equivalents. Grains servings are defined as 1 slice of bread, 1 ounce of ready-to-eat cereal, or ½ cup of cooked cereal, rice or pasta. Dairy servings are defined as approximately equivalent to the amount of calcium in 1 cup of milk or yogurt, 1½ ounces of natural cheese, or 2 ounces of processed cheese.

Means for Models 2 and 3 represent adjusted means.

Means with differing subscripts are significantly different, $p < .05$. Means with the same subscript are not significantly different. Model 1 contains only fast-food consumption. Model 2 adjusts for age, education (some college versus or college graduate versus all others), employment status (employed versus not employed), marital status (married or living with partner versus all others), and physical activity. Model 3 adjusts for all of the variables in Model 2 plus total kcal/day. Model 3 was not performed for the three fat variables (expressed as percentage of caloric intake) because they were already adjusted for caloric intake.