Original Report:
Public Health

Dietary Intake, Behaviors and Psychosocial Factors Among Women from Food-Secure and Food-Insecure Households in the United States

Patricia A. Sharpe, PhD, MPH[1*]; Kara Whitaker, PhD, MPH[2*];
Kassandra A. Alia, MA[3]; Sara Wilcox, PhD[4,5];
Brent Hutto, MSPH[5]

Objective: Determine whether macro- and micro-nutrient intake, energy intake, diet quality, adherence to recommended dietary intake, and psychosocial and behavioral factors are associated with household food security.

Design: Baseline data from in-person interviews and telephone-based, 24-hour dietary recall from women recruited to a diet and physical activity controlled trial.

Setting: Neighborhoods encompassing 18 urban census tracts in South Carolina.

Participants: Participants (n=202) were predominantly African American (87%), overweight or obese women aged 25 to 51 years with mean body mass index of 40.6±8.7.

Main Outcomes Measures: Macro- and micro-nutrient intake, energy intake, diet quality, adherence to recommended dietary intake (via multi-pass, 24-h recall); diet-related self-efficacy and social support, healthy/lowfat and emotional eating behaviors, and depressive symptoms.

Results: Women in food-secure (FS) and food insecure (FI) households were not different on health and sociodemographic characteristics. Women in FI households had lower self-efficacy and healthy/low-fat eating behaviors, and higher emotional eating and depressive symptoms compared with women in FS households. The groups did not differ on social support. Significant dietary differences were few (FS>FI on protein and lean meat; FS<FI on carbohydrate intake). For 29 of 35 (74%) dietary intake recommendations, less than 75% of women in both groups met each recommendation.

Conclusions: While food security status was associated with diet-related psychosocial and behavioral factors, it was associated with few aspects of dietary intake. Dietary intake overall was poor. Participants were not meeting guidelines for a diet supportive of general health or weight loss and management, regardless of food security status. *Ethn Dis*. 2016;26(2):139-146; doi:10.18865/ed.26.2.139

Keywords: Food Insecurity; Poverty; Food Security; African American Women

[1]College of Social Work, University of South Carolina, Columbia, SC
[2]Department of Epidemiology and Community Health, University of Minnesota, Minneapolis, MN
[3]Department of Psychology, College of Arts and Sciences, University of South Carolina, Columbia, SC
[4]Department of Exercise Science, Arnold School of Public Health, University of South Carolina, Columbia, SC
[5]Prevention Research Center, Arnold School of Public Health, University of South Carolina, Columbia, SC

*At the time the research was conducted, Drs. Sharpe and Whitaker were with the Arnold School of Public Health, University of South Carolina.

Address correspondence to Patricia A. Sharpe, PhD, MPH; University of South Carolina College of Social Work, Hamilton Bldg.; 1512 Pendleton Street; Columbia, SC 29208; 803.777.4791; sharpep@mailbox.sc.edu

Introduction

Disparities in obesity, chronic disease risk, and diet quality are well-documented between African American and White women in the United States. Non-Hispanic Black women (58.6%) are significantly more likely to be overweight or obese than non-Hispanic White (33.4%) and Hispanic (40.7%) women[1] and to have diets of lower nutritional quality.[2,3]

Observational studies suggest that food insecurity is associated with obesity,[4-8] chronic diseases and pregnancy complications.[9-11] The food insecurity-obesity relationship has been found most consistently among women;[4,5,8] the evidence among men and children is mixed.[12] The association has not been found consistently across racial and ethnic groups. Battacharya and colleagues[7] found an association between food insecurity and obesity among Hispanics and Whites but not among African Americans in a national sample.

Across diverse studies, findings have been inconsistent regarding the association between food security status and dietary factors. In total, these studies suggest that food insecurity is predictive of a poor diet;[7,13-22] however, few examined this association among or within racial and ethnic groups. National data showed that poverty-level income was associated with lower diet quality among both White and Black, but not Hispanic, respondents, while

food insecurity predicted lower diet quality only among Whites,[7] suggesting that income and food security are not synonymous in their associations with dietary outcomes, nor consistent across racial and ethnic groups. Further, while observational studies indicate that neighborhood poverty is associated with lower availability of and access to healthy foods, there is no clear evidence of a causal association between food availability/convenience and health or diet-related outcomes across racial or ethnic subgroups.[23] The specific interrelationships among food insecurity, poverty, race/ethnicity, community environment and obesity among and within these subgroups remain unclear.

…we hypothesized that women in food-secure households would have a more positive diet-related psychosocial status, better macro- and micronutrient intake and diet quality, and better adherence to recommended dietary intake levels than women in food-insecure households.

The purpose of our study was to determine whether dietary intake and quality, energy intake, adherence to recommendations, and psychosocial and behavioral factors differed by household food security status (food secure vs insecure) among mainly African American women who were overweight or obese and recruited from census tracts of high poverty in central South Carolina. This sample allowed us to test for an association between food security status and dietary intake within a relatively homogeneous sample of participants. While the study was primarily descriptive, we hypothesized that women in food-secure households would have a more positive diet-related psychosocial status, better macro- and micronutrient intake and diet quality, and better adherence to recommended dietary intake levels than women in food-insecure households.

Methods

Baseline data were from a randomized controlled trial,[24] a behavioral intervention to reduce body weight, increase physical activity, and improve dietary intake. Women aged 25-50 years were recruited from 18 census tracts in Columbia, South Carolina, within a Standard Metropolitan Statistical Area of more than 500,000. Of 61 tracts, these tracts had ≥ 25% (25%-62%) of residents with below-poverty income. Eligibility included body mass index ≥25 kg/m^2 and waist circumference ≥88 cm (detailed inclusion criteria are in print).[24]

A community advisory board of women leaders from the neighborhoods assisted with recruitment. Staff persons screened potential participants by phone. Initially eligible women attended in-person measurement. Staff persons collected baseline data from three cohorts during November through mid-December, 2008 and October through mid-December, 2009 and 2010. For ethical reasons, food-insecure women received food assistance referrals.

Main Measures

Sociodemographic and Health Variables

Participants self-reported their age, number of dependent children at home, race, Hispanic ethnicity, education, employment, health insurance, 10 health conditions (yes/no) and marital status. The Actigraph accelerometer, GT1M model, (ActiGraph, LLC, Fort Walton Beach, FL) assessed seven days of physical activity.

Body Mass Index

Staff obtained height to the nearest quarter inch and weight to the nearest tenth kilogram. Body mass index was calculated as weight in kg/height in m^2.

Waist Circumference

Staff used the iliac crests as landmarks for waist circumference to the nearest tenth centimeter.[25]

Food Security Status

The six-item short form of the 12-month Food Security Scale[26] measured financially based food security. The short form classifies 97.7% households correctly and underestimates overall food insecurity by .3%.[26] Scoring categorized households as food secure or insecure.

Depressive Symptoms.

The validated short form of the Center for Epidemiological Studies Depression Scale (CESD-10)[27] assessed depressive symptoms. A cut-

point of 10 has shown sensitivity of 77% and specificity of 79% relative to a structured clinical interview.[28] Cronbach's alpha in this sample was .83.

Dietary Intake

Registered dieticians trained in the University of Minnesota's Nutrient Data System for Research (NDSR) protocols conducted three 24-hour dietary recall interviews by telephone (two week days and one weekend day). The multi-pass, 24-hour dietary recall methodology has established validity and reliability.[29,30] Participants received a 20-minute training in portion size estimation using a Food Portion Visual,[31] with the addition of food models, dishes and utensils, then completed their first 24-hour dietary recall. The remaining two recalls occurred within 15 days. Average time between the first and third interviews was 9.5 days. Dietary data were collected and analyzed using Nutrition Data System for Research software version 5.0_35, (2005), Nutrition Coordinating Center, University of Minnesota, Minneapolis, MN. Serving sizes and referent intake levels were defined by the NDSR manual©[32] and 2005 Dietary Guidelines for Americans,[33] Institute of Medicine[34,35] and American Heart Association,[36] as these guidelines were in effect when data collection began.

Self-Efficacy for Healthy Eating

An eight-item self-efficacy scale for eating a low-fat diet[37] was modified to assess self-efficacy for "making healthy food choices, such as choosing fruits or vegetables, choosing lower fat foods, and watching how much you eat" when faced with common barriers. The original scale demonstrated construct, convergent validity, and Cronbach's alpha > .82.[37] Cronbach's alpha in this sample was .75.

Social Support for Healthy Eating

In a separate sample of middle-aged SC women (60% African American), we created and validated a measure of social support for healthy eating. Respondents rated to what extent "family members, friends, co-workers, or anyone else close to you" engaged in 11 supportive behaviors. In the validation sample, the scale had good construct validity, with factor loadings from .65 to .82 and Cronbach's alpha of .93. Cronbach's alpha in this sample was .92.

Healthy/Low-Fat Eating

We modified eight items from the Eating Behavior Patterns Questionnaire to assess healthy and low-fat eating behaviors.[38] The original subscale had construct validity and internal consistency reliability (Cronbach's alpha = .84) among African American women.[38] Cronbach's alpha in this sample was .70.

Emotional Eating

The tendency to eat in response to negative emotions was assessed with four items (eating when upset, for comfort, when not hungry, eating until package of food was finished) from the emotional eating subscale of the Eating Behavior Patterns Questionnaire.[38] This subscale had acceptable internal consistency reliability (α = .77) and construct validity in African American women.[38] In this sample, Cronbach's alpha was .66. Higher scores indicated less emotional eating.

Diet Quality

The Alternative Healthy Eating Index (AHEI) has been strongly associated with health outcomes.[39,40] The original AHEI consists of nine components: vegetables, fruit, non-meat proteins, ratio of white to red meat, cereal/grain-based fiber intake, trans-fat, ratio of polyunsaturated to saturated fat, duration of multivitamin use, and alcohol use. We did not have data on multi-vitamin use, so the possible range of scores was 0 to 80, with a higher score indicating a higher-quality diet.

Statistics

The Statistical Analysis System 9.2 (Cary, NC) computed means, standard deviations, frequencies, and percentages. T-tests and chi-squared tests (or Fisher's exact test for cell sizes <5) were computed to determine comparability of women from food-secure and food-insecure households on socio-demographic, health-related, psychosocial and dietary variables.

Results

Of calls attempted to 746 potential participants who responded to recruitment materials, 657 women were screened for eligibility, 307 met inclusion criteria, and 230 provided informed consent; 26 women were excluded after consent because of medical contraindications and other exclusion criteria. Of the remaining 204 women, two did not complete the dietary recall.

The sample (n=202) was predominantly African American (87.1%) and most were obese (94.5%). The women from food-secure (n=124) and food-insecure (n=78) households were not significantly different on any of the health, anthropometric and sociodemographic characteristics shown in Table 1.

As shown in Table 2, women

Table 1. Health and sociodemographic characteristics among women from food-secure and food-insecure households

		Total, n=202		Food Secure, n=124		Food Insecure, n=78		Test statistic	
Characteristic		**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**t**	**P**
Age, y		38.2	7.6	38.3	7.7	37.9	7.5	.36	.72
Children <18 y in household		1.0	1.2	1.0	1.3	1.1	1.1	.62	.54
Waist circumference, cm		117.0	17.3	116.4	17.4	117.9	17.1	.62	.53
Weight, kg		109.6	26.0	109.5	26.4	109.9	25.7	.10	.91
Body mass index, weight kg/ height m^2		40.6	8.7	40.4	8.6	40.9	8.9	.37	.71
Self-reported medical condition (0-10)[a]		1.2	1.1	1.2	1.1	1.2	1.2	-.23	.82
		n[b]	%[b]	n[b]	%[b]	n[b]	%[b]	Fisher's exact	P
Ethnicity	Hispanic	6	3.0	5	4.1	1	1.3		.41
								X^2	P
Race	White	16	7.9	11	8.9	5	6.4	7.8	.68
	African American	176	87.1	106	85.5	70	89.7		
	> One race	10	5.0	7	5.7	3	3.9		
Education	< High school	11	5.5	4	3.2	7	8.9	3.1	.21
	High school/GED	31	15.4	19	15.3	12	15.4		
	> High school	160	79.2	101	81.5	59	75.6		
Employment	Employed	148	73.3	91	73.4	57	73.1	.14	.93
	Not employed	37	18.3	22	17.7	15	19.2		
	Student	17	8.4	11	8.9	6	7.7		
Marital status	Not married	86	42.6	47	37.9	39	50.0	4.3	.23
	Married	42	20.8	30	24.2	12	15.4		
	Divorced/separated	56	27.7	34	27.4	22	28.2		
	Unmarried couple	18	8.9	13	10.5	5	6.4		
Health insurance	Yes, has coverage	153	75.7	99	79.8	54	69.2	2.9	.09
Physical activity	< recommendation[c]	178	90.8	110	91.7	68	89.5	.27	.60

a. Has a doctor told you that you have now or have had in the past (yes, no): heart condition, stroke, cancer, diabetes ("high sugar"), high blood pressure/hypertension, skeletal or muscle injury, arthritis or autoimmune disease, peripheral artery disease, lung condition (asthma, dyspnea, shortness of breath, chronic obstructive pulmonary disease), kidney disease.
b. Total N may not be 202 for every characteristic because of missing data; rounded percentages.
c. ≥5 days of 30 min. moderate-intensity or ≥3 days of 20 min. vigorous-intensity physical activity week, in bouts of ≥10 min

in food-insecure households had lower self-efficacy for healthy eating, lower healthy/low-fat eating behaviors, and higher emotional eating (ie, lower scores) and depressive symptoms compared with women in food-secure households. Social support was unrelated to food security.

Table 3 shows mean intake for selected nutrients and food groups and the modified AHEI score. Women from food-insecure households had significantly lower intake of protein and lean meat, and significantly higher carbohydrate intake compared with women in food-secure households but showed no other significant differences.

Table 4 shows the results for dietary guidelines. Nearly twice as many women in food-secure households (24.4%) as food-insecure (12.8%) met the recommendation that lean meat comprise ≥75% of total meat intake. No other significant differences were found. Of note is the very small proportion (<25%) of women in both groups who met recommendations that are important for weight control and a healthy diet regarding fiber, fruits and vegetables, whole grains, lean meats, low-fat dairy, fat, added sugars and sweetened drinks. The proportions of all women who met recommendations for calcium, iron, magnesium, potassium, sodium, vitamins D and E, and pantothenic acid were very low (≤25% of women). For 29 of 35 (74%) dietary intake guidelines examined, less than 75% of women in both groups met each recommendation.

Discussion

A strength of this study is the sample's inclusion of a large proportion of African American and multi-racial women (92%) with high educational

Table 2. Comparison of psychosocial and behavioral factors between women in food-secure and food-insecure households

	Food-secure			Food-insecure				
Characteristic	**n**	**Mean (SD)**	**Min, Max**	**n**	**Mean (SD)**	**Min, Max**	**t**	**P**
Depressive symptoms score[a]	124	8.3 (5.0)	2.0, 24.0	78	10.9 (6.1)	2.0, 29.0	3.36	.001
Self-efficacy for healthy eating[b]	124	19.2 (4.5)	9.0, 29.0	78	17.6 (4.0)	10.0, 29.0	2.55	.01
Social support for healthy eating[c]	120	31.1 (10.5)	11.0, 53.0	77	28.6 (10.4)	11.0, 53.0	1.64	.10
Healthy/low-fat eating score[d]	124	23.5 (5.5)	8.0, 36.0	77	21.9 (6.4)	9.0, 32.0	1.97	.05
Emotional eating score[e]	124	11.4 (3.8)	4.0, 20.0	78	10.2 (3.1)	4.0, 17.0	2.45	.02

a. 0-30, higher scores indicate greater depressive symptoms
b. 8-32, higher scores indicate greater self-efficacy for healthy eating
c. 11-55, higher scores indicate greater social support for healthy eating
d. 8-40, higher scores indicate healthier/ lower-fat eating behaviors
e. 4-20, higher scores indicate lower levels of emotional eating

attainment, all of whom lived in areas of high poverty in the urban southeastern USA. We obtained 24-hour dietary recall call data from a validated procedure considered the state-of-the-art in community-based studies among participants who are often labelled "hard-to-reach." Nevertheless, the study has several limitations that must be considered when interpreting the results. There was a lack of temporal congruence between the food security measure (retrospective recall of the past 12 months) and the dietary recall, a common limitation in this literature. We

Table 3. Comparison of dietary intake between women in food-secure and food-insecure households

	Food secure n=124			Food insecure n=78				
Dietary intake	**Mean**	**SD**	**Min, Max**	**Mean**	**SD**	**Min, Max**	**t**	**P**
Kcals/d	1906	825	645, 7174	1955	656	717, 3747	.45	.65
AHEI, modified	30.8	9.8	10.4, 57.9	28.6	8.8	12.8, 57.9	1.7	.10
% of total kcals/d								
Total fat	35.4	5.9	19.4, 55.6	34.5	6.4	18.8, 50.4	1.10	.27
Saturated fat	11.2	2.5	5.4, 22.0	11.2	2.8	5.1, 18.2	.1	.91
Trans fat	2.2	1.1	.3, 6.1	2.1	1.0	.5, 4.7	.35	.73
Protein	16.2	4.3	7.3, 35.8	15.1	3.2	8.55, 24.6	2.02	.05
Carbohydrate	47.7	8.0	28.7, 70.0	50.1	7.8	34.1, 66.8	2.06	.04
Grams/d								
Added sugars	87.6	73.4	.8, 665.9	100.6	54.0	3.64, 254.8	1.35	.18
Fiber	13.4	6.4	3.0, 31.0	12.8	6.4	3.1, 37.7	.61	.54
Milligrams/d								
Sodium	3251	1343	985, 8003	3105	1084	1437, 5999	.81	.42
Servings/d								
Vegetables	2.5	1.4	.3, 7.5	2.3	1.4	0, 5.8	.94	.35
Fruits	1.0	1.0	0, 4.9	.9	1.0	0, 4.2	.30	.76
Fruits & vegetables	3.4	1.7	.3, 12.3	3.2	1.8	0, 10.0	.92	.36
Total grains	5.8	3.0	1.0, 19.8	5.8	2.5	1.6, 13.4	.00	.98
Whole grains	.7	.9	0, 4.5	.7	1.1	0, 4.9	.10	.92
Refined grains	4.8	2.9	0, 19.8	4.9	2.4	.2, 11.1	.17	.87
Dairy	1.1	1.0	0, 5.4	1.2	.9	0, 3.9	.39	.70
Low-fat dairy	.1	.2	0, 1.7	.2	.3	0, 1.2	1.30	.19
Meat	5.2	2.7	0, 13.2	5.3	2.9	.2, 19.7	.17	.86
Lean meat	2.6	2.1	0, 10.3	2.0	1.7	0, 7.5	2.12	.04
Beans	.1	.2	0, 1.3	.1	.2	0, .9	1.50	.13
Meat alternatives	0	.1	0, .6	0	.2	0, 1.2	1.37	.17
Sweetened beverages	2.1	1.8	0, 9.6	2.4	1.7	0, 6.6	1.16	.25
Alcoholic beverages	.1	.3	0, 2.2	.1	.5	0, 4.2	.10	.91

Table 4. Proportion of women meeting dietary guidelines by household food security status

Macronutrient/ food group	Dietary guideline, daily	Total meeting guideline, n=202		Food secure meeting guideline, n=124		Food insecure meeting guideline, n=78		Test statistic	
		n[a]	%	n	%	n	%	X^2	P
Kilocalories	<2,000[33b]	123	60.8	81	65.3	42	53.9	2.65	.10
Fat[c]	20-35% of total kcals[33,34]	99	49.0	61	49.2	38	48.7	1.01	.60
Saturated fat	<10% of total kcals[33]	58	28.7	34	27.4	24	30.8	.26	.61
Trans fat	0% of total kcals[33]	23	11.4	14	11.3	9	11.5	0	.96
Protein[c]	10-35% of total kcals[33,34]	192	95.0	119	96.0	73	93.6	1.75	.42
Carbohydrate[c]	45-65% of total kcals[33,34]	129	63.9	77	62.1	52	66.7	3.09	.21
Fiber	≥25 grams[33,34]	12	5.9	7	5.7	5	6.4	.05	.82
Fruits/vegetables	≥5servings[33]	32	15.8	20	16.1	12	15.4	.02	.89
Whole grains	≥50% of grain intake[33]	6	2.9	4	3.2	2	2.6	.07	.79
Low-fat diary	≥75% of dairy intake[33]	8	4.0	3	2.5	5	6.4	1.96	.16
Lean meat	≥75% of meat intake[33]	40	19.9	30	24.4	10	12.8	4.01	.05
Sweetened drinks	0 servings[33]	23	11.4	17	13.7	6	7.7	1.72	.19
Added sugars	≤100 kcals[33,35]	15	6.9	12	9.7	3	3.9	2.37	.12
Alcohol	≤1 serving[33]	194	96.0	119	96.0	75	96.2	0	.95
Minerals									
Calcium	≥1,000 mg.[34]	27	13.4	18	14.5	9	11.5	.37	.55
Iron	≥18 mg.[34]	36	17.8	23	18.6	13	16.7	.12	.73
Magnesium	≥320 mg[34]	25	12.4	13	10.5	12	15.4	1.06	.30
Phosphorus	≥700 mg[34]	160	79.2	98	79.0	62	79.5	.01	.94
Potassium	≥4,700 mg[33,34]	1	.04	0	0	1	1.3	1.60	.21
Sodium	<1,500 mg[33,34]	49	24.3	27	21.8	22	28.2	1.08	.30
Zinc	≥8 mg[34]	113	55.9	66	53.2	47	60.3	.96	.33
Copper	≥.9 mg[34]	115	56.9	68	54.8	47	60.3	.57	.45
Selenium	≥55 mcg[34]	181	89.6	112	90.3	69	88.5	.18	.67
Vitamin A	≥2,333 IU[34]	114	56.4	71	57.3	43	55.1	.09	.77
Vitamin D	≥15 mcg[34]	4	19.8	4	3.2	0	.0	2.57	.11
Vitamin E	≥15 mg[34]	26	12.9	16	12.9	10	12.8	.0	.99
Vitamin K	≥90 mcg[34]	89	44.1	57	46.0	32	41.0	.47	.49
Vitamin C	≥75 mg[34]	83	41.1	51	41.1	32	41.0	.0,	.99
Thiamin/B1	≥1.1 mg[34]	130	64.4	80	64.5	50	64.1	.0	.95
Riboflavin/B2	≥1.1mg[34]	157	77.7	96	77.4	61	78.2	.02	.90
Niacin/B3	≥14 mg[34]	169	83.4	101	81.5	68	87.2	1.15	.28
Folate	≥400 mcg[f]	55	27.2	33	26.6	22	28.2	.06	.81
Vitamin B6	≥1.1mg[34]	129	63.9	78	62.9	51	65.4	.13	.72
Vitamin B12	≥2.5mcg[34]	133	65.8	80	64.5	53	68.0	.25	.62
Pantothenic acid	≥5 mg[34]	51	25.2	32	25.8	19	24.4	.05	.82

a. n=4 women reported no dairy and are omitted from this analysis. n=1 woman reported no meat and is omitted from this analysis.
b. Caloric needs based on Estimated Energy Requirement equations for moderately active female adults between 31-50 years old, per the Institute of Medicine. Overweight and obese women will logically have individualized requirements for weight loss or maintenance.
c. For % of kcals from total fat, protein and carbohydrate, a trichotomy of "below," "within," or "above" the recommended intake range was tested. Only 3% of all women exceeded 65% of kcals from carbohydrates, and .5% exceeded 35% of kcals from protein, but 49.5% exceeded 35% of kcals from total fat. All other tests compared "meets" to "does not meet" the recommendation, as defined by cited sources.

used a short measure of food insecurity and analyzed food security as a dichotomy. Other measures provide multiple categories (eg, secure, marginal, low and very low), but researchers often collapse these. Whether the association of food security to dietary intake approximates a linear trend across categories, or is best represented by some other dichotomy (eg, very low vs all others) or a continuous measure, remains to be investigated.

It is challenging in a single study to measure all potential influences on dietary intake that may differ by food security status or have greater relevance than food security to dietary outcomes. Our food-secure and food-insecure groups were similar on health and sociodemographic variables, but may have differed on other factors, such as household income, which were not measured.

On the community advisory board's advice, we did not measure household income; however, all women were from high-poverty tracts. Low neighborhood SES is a significant predictor of negative health impacts, including weight gain among college-educated Black women.[41] It is noteworthy that others have found adjustments for income and food assistance benefits in similarly disadvantaged samples produced *more* non-significant findings (or made no difference) for associations between food security and both diet quality and intake;[18] thus, the fact that we could not adjust for household income or food assistance benefits is not a likely explanation for our findings of mainly non-significant differences between women from food-secure and food-insecure households. The relative importance of food security and income compared with other influences on dietary intake, such as taste preferences, socio-cultural foodways, and the neighborhood food environment, remains unsettled.

Of note is the very small proportion (<25%) of women in both groups who met recommendations that are important for weight control and a healthy diet regarding fiber, fruits and vegetables, whole grains, lean meats, low-fat dairy, fat, added sugars and sweetened drinks.

Conclusion

Our study contributes to the literature on food security and dietary intake by comparing women in food-secure and food-insecure households in a relatively homogeneous sample of overweight/obese, mainly African American women from neighborhoods of high poverty. There were few differences in dietary intake, contrary to our hypothesis. Compared with studies cited above, we found fewer statistically significant differences by food security status; however, differences of small magnitude (eg, .10 to .20 serving)[22] between food security categories reach statistical significance in very large national samples. Our study confirms findings across other studies that poor nutrition is prevalent regardless of food security status, a profile that leads to elevated chronic disease risk and threatens effective chronic disease management, thereby contributing to health disparities.

Acknowledgments

The University of South Carolina's Institutional Review Board approved the study procedures, which were performed in accordance with ethical standards as laid down in the with the Helsinki Declaration of 1975, as revised in 2000. Trained interviewers obtained written informed consent in person. Supported by Grant Number R01DK074666 from the National Institute of Diabetes and Digestive and Kidney Diseases. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute of Diabetes and Digestive and Kidney Diseases or the National Institutes of Health. The authors appreciate the work of the research team and community advisory board.

Conflict of Interest

No conflicts of interest to report.

Author Contributions

Research concept and design: Sharpe, Wilcox, Hutto; Acquisition of data: Sharpe, Wilcox; Data analysis and interpretation: Sharpe, Whitaker, Alia, Wilcox, Hutto; Manuscript draft: Sharpe, Whitaker, Alia, Hutto; Statistical expertise: Hutto; Acquisition of funding: Sharpe; Administrative: Sharpe, Whitaker, Alia, Wilcox; Supervision: Sharpe

References

1. Flegal KM, Carroll MD, Kit BK, Ogden CL. Prevalence of obesity and trends in the distribution of body mass index among US adults, 1999-2010. *JAMA*. 2012;307(5):491-497. http://dx.doi.org/10.1001/jama.2012.39. PMID:22253363.
2. Kirkpatrick SI, Dodd KW, Reedy J, Krebs-Smith SM. Income and race/ethnicity are associated with adherence to food-based dietary guidance among US adults and children. *J Acad Nutr Diet*. 2012;112(5):624-635.e6. http://dx.doi.org/10.1016/j.jand.2011.11.012. PMID:22709767.
3. Kant AK, Graubard BI, Kumanyika SK. Trends in black-white differentials in dietary intakes of U.S. adults, 1971-2002. *Am J Prev Med*. 2007;32(4):264-272. http://dx.doi.org/10.1016/j.amepre.2006.12.011. PMID:17383557.
4. Martin KS, Ferris AM. Food insecurity and gender are risk factors for obesity. *J Nutr Educ Behav*. 2007;39(1):31-36. http://dx.doi.org/10.1016/j.jneb.2006.08.021. PMID:17276325.
5. Pan L, Sherry B, Njai R, Blanck HM. Food insecurity is associated with obesity among US adults in 12 states. *J Acad Nutr Diet*. 2012;112(9):1403-1409. http://dx.doi.org/10.1016/j.jand.2012.06.011. PMID:22939441.
6. Nackers LM, Appelhans BM. Food insecurity is linked to a food environment promoting obesity in households with children. *J Nutr Educ Behav*. 2013;45(6):780-784. http://dx.doi.org/10.1016/j.jneb.2013.08.001. PMID:24021456.
7. Bhattacharya J, Currie J, Haider S. Poverty, food insecurity, and nutritional outcomes in children and adults. *J Health Econ*. 2004;23(4):839-862. http://dx.doi.org/10.1016/j.jhealeco.2003.12.008. PMID:15587700.
8. Dinour LM, Bergen D, Yeh M-C. The food insecurity-obesity paradox: a review of the literature and the role food stamps may play.

J Am Diet Assoc. 2007;107(11):1952-1961. http://dx.doi.org/10.1016/j.jada.2007.08.006. PMID:17964316.
9. Laraia BA, Siega-Riz AM, Gundersen C. Household food insecurity is associated with self-reported pregravid weight status, gestational weight gain, and pregnancy complications. *J Am Diet Assoc*. 2010;110(5):692-701. http://dx.doi.org/10.1016/j.jada.2010.02.014. PMID:20430130.
10. Seligman HK, Laraia BA, Kushel MB. Food insecurity is associated with chronic disease among low-income NHANES participants. *J Nutr*. 2010;140(2):304-310. http://dx.doi.org/10.3945/jn.109.112573. PMID:20032485.
11. Gowda C, Hadley C, Aiello AE. The association between food insecurity and inflammation in the US adult population. *Am J Public Health*. 2012;102(8):1579-1586. http://dx.doi.org/10.2105/AJPH.2011.300551. PMID:22698057.
12. Larson NI, Story MT. Food insecurity and weight status among U.S. children and families: a review of the literature. *Am J Prev Med*. 2011;40(2):166-173. http://dx.doi.org/10.1016/j.amepre.2010.10.028. PMID:21238865.
13. Kendall A, Olson CM, Frongillo EA Jr. Relationship of hunger and food insecurity to food availability and consumption. *J Am Diet Assoc*. 1996;96(10):1019-1024. http://dx.doi.org/10.1016/S0002-8223(96)00271-4. PMID:8841164.
14. Rose D, Oliveira V. Nutrient intakes of individuals from food-insufficient household in the United States. *Am J Public Health*. 1997;87(12):1956-1961. PMID:9431283
15. Dixon LB, Winkleby MA, Radimer KL. Dietary intakes and serum nutrients differ between adults from food-insufficient and food-sufficient families: Third National Health and Nutrition Examination Survey, 1988-1994. *J Nutr*. 2001;131(4):1232-1246. PMID:11285332.
16. Lee JS, Frongillo EA Jr. Nutritional and health consequences are associated with food insecurity among U.S. elderly persons. *J Nutr*. 2001;131(5):1503-1509. PMID:11340107.
17. Tarasuk VS. Household food insecurity with hunger is associated with women's food intakes, health and household circumstances. *J Nutr*. 2001;131(10):2670-2676. PMID:11584089.
18. Champagne CM, Casey PH, Connell CL, et al; Lower Mississippi Delta Nutrition Intervention Research Initiative. Poverty and food intake in rural America: diet quality is lower in food insecure adults in the Mississippi Delta. *J Am Diet Assoc*. 2007;107(11):1886-1894. http://dx.doi.org/10.1016/j.jada.2007.08.003. PMID:17964307.
19. Kirkpatrick SI, Tarasuk V. Food insecurity is associated with nutrient inadequacies among Canadian adults and adolescents. *J Nutr*. 2008;138(3):604-612. PMID:18287374.
20. Zizza CA, Duffy PA, Gerrior SA. Food insecurity is not associated with lower energy intakes. *Obesity (Silver Spring)*. 2008;16(8):1908-1913. http://dx.doi.org/10.1038/oby.2008.288. PMID:18535545.
21. Robaina KA, Martin KS. Food insecurity, poor diet quality, and obesity among food pantry participants in Hartford, CT. *J Nutr Educ Behav*. 2013;45(2):159-164. http://dx.doi.org/10.1016/j.jneb.2012.07.001. PMID:23219294.
22. Leung CW, Epel ES, Ritchie LD, Crawford PB, Laraia BA. Food insecurity is inversely associated with diet quality of lower-income adults. *J Acad Nutr Diet*. 2014;114(12):1943-53.e2. http://dx.doi.org/10.1016/j.jand.2014.06.353. PMID:25091796.
23. Gordon-Larsen P. Food availability/convenience and obesity. *Adv Nutr*. 2014;5(6):809-817. http://dx.doi.org/10.3945/an.114.007070. PMID:25398746.
24. Wilcox S, Sharpe PA, Parra-Medina D, Granner M, Hutto B. A randomized trial of a diet and exercise intervention for overweight and obese women from economically disadvantaged neighborhoods: Sisters Taking Action for Real Success (STARS). *Contemp Clin Trials*. 2011;32(6):931-945. http://dx.doi.org/10.1016/j.cct.2011.08.003. PMID:21864718.
25. Centers for Disease Control and Prevention. National Health and Nutrition Examination Survey (NHANES) Anthropometry Procedures Manual. 2007. http://www.cdc.gov/nchs/data/nhanes/nhanes_07_08/manual_an.pdf Accessed August 24, 2015.
26. Blumberg SJ, Bialostosky K, Hamilton WL, Briefel RR. The effectiveness of a short form of the Household Food Security Scale. *Am J Public Health*. 1999;89(8):1231-1234. http://dx.doi.org/10.2105/AJPH.89.8.1231. PMID:10432912.
27. Radloff LS. The CES-D scale a self-report depression scale for research in the general population. *Appl Psychol Meas*. 1977;1(3):385-401. http://dx.doi.org/10.1177/014662167700100306.
28. McManus D, Pipkin SS, Whooley MA. Screening for depression in patients with coronary heart disease (data from the Heart and Soul Study). *Am J Cardiol*. 2005;96(8):1076-1081. http://dx.doi.org/10.1016/j.amjcard.2005.06.037. PMID:16214441.
29. Jonnalagadda SS, Mitchell DC, Smiciklas-Wright H, et al. Accuracy of energy intake data estimated by a multiple-pass, 24-hour dietary recall technique. *J Am Diet Assoc*. 2000;100(3):303-308. http://dx.doi.org/10.1016/S0002-8223(00)00095-X. PMID:10719403.
30. Posner BM, Borman CL, Morgan JL, Borden WS, Ohls JC. The validity of a telephone-administered 24-hour dietary recall methodology. *Am J Clin Nutr*. 1982;36(3):546-553. PMID:6180624.
31. Weber JL, Tinsley AM, Houtkooper LB, Lohman TG. Multimethod training increases portion-size estimation accuracy. *J Am Diet Assoc*. 1997;97(2):176-179. http://dx.doi.org/10.1016/S0002-8223(97)00046-1. PMID:9020247.
32. Nutrition Coordinating Center. Nutrient Data System for Research Manual (Online manual, 1998-2006©). Minneapolis, MN: Regents of the University of Minnesota. Accessed August 24, 2015.
33. US Department of Health Human Services and US Department of Agriculture. Dietary guidelines for Americans, 2005, 6th Edition. Washington, D.C.: U.S. Government Printing Office; 2005. http://health.gov/Dietaryguidelines/dga2005/document/default.htm Accessed August 23, 2015.
34. Institute of Medicine. Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids. Washington, D.C.: The National Academies Press; 2002. http://www.nal.usda.gov/fnic/DRI/DRI_Energy/energy_full_report.pdf Accessed August 24, 2015.
35. Institute of Medicine. Dietary Reference Intakes: The essential guide to nutrient requirements. Washington, D.C.: The National Academies Press, 2006. http://www.nal.usda.gov/fnic/DRI/Essential_Guide/DRIEssentialGuideNutReq.pdf Accessed August 24, 2015.
36. Johnson RK, Appel LJ, Brands M, et al; American Heart Association Nutrition Committee of the Council on Nutrition, Physical Activity, and Metabolism and the Council on Epidemiology and Prevention. Dietary sugars intake and cardiovascular health: a scientific statement from the American Heart Association. *Circulation*. 2009;120(11):1011-1020. http://dx.doi.org/10.1161/CIRCULATIONAHA.109.192627. PMID:19704096.
37. Chang M-W, Nitzke S, Brown RL, Baumann LC, Oakley L. Development and validation of a self-efficacy measure for fat intake behaviors of low-income women. *J Nutr Educ Behav*. 2003;35(6):302-307. http://dx.doi.org/10.1016/S1499-4046(06)60344-8. PMID:14642215.
38. Schlundt DG, Hargreaves MK, Buchowski MS. The Eating Behavior Patterns Questionnaire predicts dietary fat intake in African American women. *J Am Diet Assoc*. 2003;103(3):338-345. PMID:12616256.
39. Fung TT, McCullough ML, Newby PK, et al. Diet-quality scores and plasma concentrations of markers of inflammation and endothelial dysfunction. *Am J Clin Nutr*. 2005;82(1):163-173. PMID:16002815.
40. McCullough ML, Willett WC. Evaluating adherence to recommended diets in adults: the Alternate Healthy Eating Index. *Public Health Nutr*. 2006;9(1A):152-157. http://dx.doi.org/10.1079/PHN2005938. PMID:16512963.
41. Coogan PF, Cozier YC, Krishnan S, et al. Neighborhood socioeconomic status in relation to 10-year weight gain in the Black Women's Health Study. *Obesity (Silver Spring)*. 2010;18(10):2064-2065. http://dx.doi.org/10.1038/oby.2010.69. PMID:20360755.