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How is food insecurity associated with dietary behaviors? An analysis with low income, ethnically diverse participants in a nutrition intervention study

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Abstract

Food insecurity has been associated with a lower nutrient intake as well as a lower intake of fruits and vegetables. However, little is known about the association of food insecurity and dietary behaviors, including food choices and preparation methods. This study examines the relationship between food insecurity and dietary behaviors of low income adults (N = 1874, 55% Hispanic) who completed the baseline telephone survey for a nutrition education study. From April 2003 to August 2004, data were collected on demographics and food security status and validated dietary measures: fruit and vegetable screener and Food Habits Questionnaire (FHQ) were used to assess fat-related behaviors (food choices or preparation methods that lead to an increase or decrease in fat intake). Chi square tests were conducted to compare each demographic variable by food security status. Univariate linear regression models examined dietary variables by food security status in univariate models initially, then in multivariable models adjusting for demographics. Half of participants reported food insecurity. FHQ scores were significantly greater in the food insecure group, reflecting a higher fat intake ($P < 0.05$). Fruit (with juice) intake was significantly greater in the food insecure participants reflecting increased juice intake ($P < 0.05$). Food insecure individuals reported a higher juice intake and a lower frequency of fat-lowering behaviors. Future interventions with food insecure individuals should include nutrition education as well as efforts to increase access and availability to healthier foods. Further qualitative and quantitative research is needed on the relationship between diet and food insecurity.

Keywords

Dietary behaviors; Food insecurity; Dietary fat; Fruit and vegetable; Low income; Hispanic

Introduction

Food insecurity is defined as, “the availability of nutritionally adequate and safe foods or the ability to acquire acceptable foods in socially acceptable ways is limited or uncertain” (1). In

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2005, 11% of households in the United States were food insecure (2). The Healthy People 2010 initiative set a goal to reduce the prevalence of food insecurity to 6% (2).

Researchers have found that food insecurity is more likely to occur in racial and ethnic minorities, low income families and households with children (2–5). In 2005, 38% of poverty-level income households were food insecure (2). Food insecurity has been shown to be related to the prevalence of overweight, especially among women (6–16). A possible explanation for this association is that foods high in calories and fat are less expensive than fruit, vegetables, lean meats and foods high in fiber (17–21). Individuals from food insufficient households have been shown to have a lower nutrient intake (5) and fruit and vegetable (FV) intake has been shown to decline as food insecurity becomes more severe (22). Thus, the nutritional value of the diets of food insecure individuals may be less than optimal, which may increase their risk of overweight and certain chronic diseases (23).

More information is needed to explain the relationship between food insecurity and dietary intake. Studies have examined nutrients, but not dietary behaviors, such as specific food choices and food preparation methods. The main purpose of this paper is to examine the relationship between food insecurity and dietary behaviors including FV consumption and fat-related dietary behaviors, which include food choices and preparation methods that lead to an increase or decrease in fat intake in predominantly low income adults who enrolled in a nutrition intervention. The hypothesis was that food insecure individuals would have a lower intake of FV and be less likely to engage in fat-lowering dietary behaviors, particularly those behaviors that could increase food costs. Understanding which dietary behaviors are associated with food insecurity will enable researchers to design more effective interventions to help food insecure individuals improve their diets and reduce their risk of overweight and other health problems (22,24).

Methods

General Design

Your Healthy Life/Su Vida Saludable (YHL/SVS) was a National Cancer Institute-funded research study that aimed to increase FV intake and reduce fat intake by developing and delivering culturally and linguistically appropriate tailored written nutrition education materials to low income individuals (25). The methods of delivering tailored nutrition information were studied in a randomized controlled trial in order to determine the most cost effective approach for dietary change. Only baseline data from the study are used in this post-hoc analysis. The study was approved by the Institutional Review Boards of Brown University and Memorial Hospital of Rhode Island.

The study design, methods, intervention features, and study results are reported in detail elsewhere (25,26). Briefly, from April 2003 to August 2004, participants were recruited from low income health clinics, health fairs and local social service agencies. Individuals were eligible to participate if they were 18 years of age or older, able to read basic English or Spanish, were not pregnant, and were not already eating a healthy diet (as described below). A total of 1874 adults enrolled in the study.

Measures

All measures were collected by telephone and are described in detail elsewhere (26). Briefly, demographic questions included gender, age, ethnicity, employment status, income, household composition, marital status and highest level of education completed. Interviewers also documented the language in which the interview was conducted.

Dietary measures—To assess FV consumption, frequencies of fruits (with and without fruit juice) and vegetables (with and without French fries) that were eaten per day over the past month were queried using the validated Fruit and Vegetable Frequency Questionnaire (27). Fat-related behaviors were assessed using the Food Habits Questionnaire (FHQ), which was adapted from the instrument developed by Kristal and colleagues (29,30) and modified to be culturally appropriate for the study population as described elsewhere (26). The FHQ asks participants 24 introductory questions regarding whether they ate particular foods in the past month; for example, “Did you eat fish or shellfish?” If individuals responded “yes”, they were asked a subsequent question(s) related to frequency of a fat related dietary behavior(s) corresponding to that food; for example, “When you ate fish, how often was it fried, like fish and chips or fried shrimp?” There were a total of 35 behavioral questions. The response options were: 0 = almost always, 1 = often, 2 = sometimes, 3 = rarely, 4 = never. If no was answered to the introductory question, the participant would skip the subsequent behavioral question(s) and continue to the next introductory question. A total FHQ score was determined by calculating the mean of responses to all non-missing fat behavioral questions. Items were reverse coded (often = 4, never = 1) as necessary so that a lower FHQ score would always reflect a lower fat intake. Participants were deemed ineligible if their FHQ responses determined that they had fewer than four fat behavior categories that had an opportunity to be improved. The FHQ was shown to accurately reflect fat intake in a calibration sub-study as reported in detail elsewhere (26).

Behavioral items from the FHQ were also combined into five fat related subscales called fat factors, similar to those introduced previously (29,30). The purpose of these fat factors is to describe types of behaviors that participants could undertake to lower fat intake including: “substitute manufactured low fat foods”, “avoid fat as a flavoring”, “modify meats to be low in fat” and “replace high fat meats with low-fat alternatives” (30). In the YHL study, the “replace high fat foods with FV” subscale was removed and a “fats related to dining out” subscale was added. FHQ fat-related subscale scores were computed by taking the mean of all the non-missing items and a higher FHQ fat factor score reflects a higher fat intake for those behaviors, or in other words, that participants were less likely to perform that particular fat lowering behavior.

Food insecurity—To measure food insecurity, participants were asked the food security question from the Behavioral Risk Factors Surveillance System (31) that is used for surveillance in many states. The question asks: “In the past 30 days, have you been concerned about having enough food for you or your family?” Response categories were yes or no. Those who answered yes were deemed food insecure.

Statistical Analysis

Food insecurity and all demographic variables were treated as categorical variables and Chi square tests were used to compare each demographic characteristic by food insecurity. Univariate linear regression models were conducted in order to compare mean FV intake, FHQ and fat factor scores by food security status. Next, separate linear regression models were constructed to compare the means of FV intake, FHQ and fat factor scores (dependent variable) by food security status (independent variable) with adjustment for demographic factors. Using forward stepwise techniques and a significance level of 0.10, food security and all significant demographic variables were added to each model. All analyses were performed using STATA (version 9.1, StataCorp, College Station, TX).

Results and Discussion

As shown in Table 1, the average age was 40 years and women accounted for 85% of the sample. Almost half (49%) of the participants were unemployed. Most participants were not currently married (63%) and most lived in households (66%) with children. Age, ethnicity, marital status, income, education status, employment status and the interview language were all statistically related (p -value <0.001) to food security status. Food secure individuals had more education than food insecure participants. Of participants with the lowest income, 74% were food insecure compared to 4% of individuals in the highest income category.

In this study of low income adults who participated in a nutrition intervention study in RI, half of the participants reported food insecurity, which is much higher than in state and national surveys (2,32). The YHL study population consisted of a higher proportion of Hispanics (55% vs. 8.7%) and a higher proportion of low income individuals (63% below \$20K in YHL vs. 30% below \$25K in RI) than the RI population (33). This likely explains the higher prevalence of food insecurity in the study sample, which is similar to regional food insecurity rates with comparable subpopulations (24,32,33,35). Compared with those who were food secure, food insecure participants in YHL were more likely to be Hispanic, less educated, unemployed, and have lower income levels. These findings are consistent with prior research (10,36,37).

As shown in Table 2, the food insecure group had a significantly higher intake of fruit (with juice) than food secure participants (both crude and adjusted). After adjusting for demographics, no other differences in FV intake by food security status were significant. In contrast, Kendall et al (22) concluded that women living in food insecure households consumed fewer vegetables than those in food secure households. Similarly, Tarasuk (38) found that women in households with no hunger had a higher mean intake of FV compared with women who had moderate or severe hunger. Frongillo et al. also found that FV consumption was lower for food insecure individuals (6). However, two of these studies did not adjust for demographic characteristics as was done in YHL. The current study found that the intake of fruit (with juice) was significantly greater in the food insecure group while fruit intake (without juice) did not differ by food security status. This finding appears to indicate that the higher fruit intake for food insecure participants is being driven by higher juice intake. Given that excess fruit juice consumption is not recommended, particularly for children (39,40), this higher juice consumption in food insecure individuals may not be an entirely positive finding. Because the population was mainly low income women, many of whom had children, it is possible that participation in the Special Supplemental Food Program for Women, Infants and Children (WIC) could be encouraging juice consumption since WIC currently provides vouchers for the purchase of juice, but not the purchase of FV. Upcoming changes to the WIC food package will provide vouchers for FV (41), which could help to improve the FV consumption of food insecure women. Further research is needed on the intake of specific FV, including juices, by food security status.

This is the first study to compare fat related eating behaviors by food security status. After adjusting for demographics, mean FHQ summary scores and the fat factor scores for “avoid fat as flavoring”, “modify meats to be low in fat”, “replace high fat meats with low fat alternatives” and “fats related to dining out” were all significantly greater in the food insecure group (p -value <0.05). These data indicate that food insecure individuals were less likely to engage in these fat-lowering behaviors and suggest a higher fat intake in this group. The fat factor score for “substitute with manufactured low fat foods” was not statistically different by food security status. Because food insecurity is related to income status, it may be difficult for food insecure individuals to afford to engage in some of the fat lowering behaviors, such as eating leaner cuts of meat or choosing specially manufactured low fat

products. However, other fat lowering behaviors such as avoiding frying, not adding fats to food, taking the skin off chicken, draining cooked hamburger or making better restaurant choices should not be cost related. Thus, a lower frequency of these behaviors by food insecure individuals may be due to personal choices, lack of knowledge or lack of food preparation skills rather than cost issues. It is also possible that for food insecure individuals, behaviors like eating chicken skin, not draining fat from meat and eating pizza with meat may offer more caloric value for the same price and decrease subsequent hunger and perceived waste.

This study has several limitations including that the study sample was not drawn randomly from the community, but consisted of volunteers for a dietary intervention study. Therefore, the results may not be generalizable to the low income population living in Rhode Island, but the study population is indicative of those who would join future intervention studies. Dietary data were all self reported, which makes them prone to social desirability bias; however, this bias would likely occur equally in both the food secure and food insecure groups. The study excluded individuals with the most healthy diets, which also decreases the generalizability of the results, but not the validity of the between-group comparisons. Further, the FHQ is not a quantitative measure of fat intake, but rather a measure of the frequency of fat-lowering behaviors. Therefore, comparisons regarding actual fat intake cannot be made; however, examining the prevalence of fat-lowering behaviors is important information for future intervention design. Finally, the food insecurity measure used in YHL is very brief in comparison to other measures and has not been validated with low income, minority populations (6,42). However, this measure is used widely for national surveillance. Further research should examine the reliability and validity of longer food insecurity measures with different subpopulations (6). In addition, cognitive assessment testing with such measures to determine how well the questions are understood and how they are being interpreted by different subpopulations would also be helpful.

Conclusion

Interventions to improve eating habits of low income individuals should focus on education to improve knowledge, skills and attitudes related to healthy eating and food preparation as well as improving access and availability to healthful foods. In addition, policy interventions such as modifying the food stamp program to include requirements or incentives for purchasing healthful foods may also be helpful (20,43–45). Further research is needed on the relationship between food insecurity and dietary behaviors including qualitative research to determine the reasons behind some of the epidemiologic findings.

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Table 1

Comparisons of participant characteristics by food security status in the Your Healthy Life study.

	Total N=1874	Food Insecure n=934 (50%)	Food Secure n=940 (50%)	p-value
Gender				
Male	278 (15%)	150 (16%)	128 (14%)	0.137
Female	1596 (85%)	784 (84%)	812 (86%)	Chi2 = 2.21
Age				
Mean ^a	40±13.0	41±11.9	40±13.9	<0.0001*
18–35	747 (40%)	328 (35%)	419 (45%)	
36–54	838 (45%)	470 (50%)	368 (39%)	Chi2 = 24.48
55 and older	289 (15%)	136 (15%)	153 (16%)	
Ethnicity				
Hispanic	1028 (55%)	560 (60%)	468 (50%)	<0.0001*
Non-Hispanic	846 (45%)	374 (40%)	472 (50%)	Chi2 = 19.57
Marital status^b				
	n=1859			<0.0001*
Married	699 (38%)	334 (36%)	365 (39%)	
Never married	623 (34%)	287 (31%)	336 (36%)	Chi2 = 17.45
Previously married	537 (29%)	309 (33%)	228 (25%)	
Income^b				
	n=1684			<0.0001*
<=20k	1060 (63%)	629 (74%)	431 (52%)	
21–40k	440 (26%)	188 (22%)	252 (30%)	Chi2 = 128.87
41k+	184 (11%)	31 (4%)	153 (18%)	
Education				
				<0.0001*
Less than High school	637 (34%)	375 (40%)	262 (28%)	
High School Graduate	575 (31%)	274 (29%)	301 (32%)	Chi2 = 34.08
Some college+	662 (35%)	285 (31%)	377 (40%)	
Employment^b				
	n=1705			<0.0001*

	Total N=1874	Food Insecure n=934 (50%)	Food Secure n=940 (50%)	p-value
Employed	873 (51%)	390 (47%)	483 (55%)	
Unemployed	832 (49%)	437 (53%)	395 (45%)	Chi2 = 10.51
Household composition				
Married & Kids	972 (52%)	482 (52%)	490 (52%)	<0.08
Single parent w/children	271 (14%)	151 (16%)	120 (13%)	Chi2 = 4.93
Just adults/alone	631 (34%)	301 (32%)	330 (35%)	
Interview language^b				
	n=1871			<0.0001*
English	972 (52%)	421 (45%)	551 (59%)	
Spanish	859 (46%)	496 (53%)	363 (39%)	Chi2 = 40.45
Both	40 (2%)	15 (2%)	25 (3%)	

^a Mean ± standard deviation

^b cells may vary due to missing values.

* indicate P-value <0.05

Table 2

Dietary scores (mean (SE)) for fruit and vegetable intake and fat related behaviors by food security status.

	Food insecure Unadjusted mean (SE)	Food secure Unadjusted Mean (SE)	Unadjusted p-value	Food insecure Adjusted mean (SE)	Food secure Adjusted Mean (SE)	Adjusted p-value
Fruit and vegetable intake						
Fruit (no juice)	1.91 (.05)	1.87 (.05)	0.58	1.88 (.05)	1.90 (.05)	0.7810 ^a
Fruit (w/juice)	3.31 (.08)	3.05 (.07)	0.0173 [*]	3.27 (.08)	3.06 (.08)	0.05 ^{b*}
Vegetables	2.51 (.06)	2.47 (.05)	0.5989	2.50 (.06)	2.46 (.06)	0.5828 ^c
Vegetables (including fries)	2.68 (.06)	2.64 (.06)	0.6016	2.69 (.06)	2.63 (.06)	0.4944 ^d
Fruit (no juice) & Vegetables (no fries)	4.42 (.09)	4.34 (.09)	0.527	4.39 (.09)	4.37 (.09)	0.8599 ^e
Fruit (w/juice) & Vegetables (no fries)	5.82 (.12)	5.51 (.11)	0.0597	5.76 (.12)	5.58 (.12)	0.2714 ^a
Fruit (w/juice) & Vegetables (w/ fries)	5.99 (.12)	5.68 (.11)	0.0615	5.93 (.12)	5.74 (.12)	0.2412 ^f
Fat-related behaviors						
Food Habits Questionnaire (FHQ) summary score	1.64 (.02)	1.60 (.02)	0.0788	1.65 (.02)	1.58 (.02)	0.0027 ^{d*}
Avoid fat as flavoring	1.74 (.02)	1.66 (.02)	0.0073 [*]	1.76 (.02)	1.64 (.02)	0.00038 [*]
Substitute w/manufactured low fat foods	2.67 (.03)	2.64 (.03)	0.5161	2.68 (.03)	2.63 (.03)	0.2010 ^h
Modify meats to be low in fat	1.61 (.03)	1.49 (.03)	0.0028 [*]	1.61 (.03)	1.49 (.03)	0.0062 ^{i*}
Replace high fat meats with low fat alternatives	1.91 (.03)	1.82 (.03)	0.0591	1.93 (.03)	1.81 (.03)	0.0089 ^{h*}
Fats related to dining out	2.64 (.03)	2.51 (.03)	0.0089 [*]	2.64 (.03)	2.53 (.03)	0.0183 ^{j*}

Note: lower score indicates lower fat intake

^{*} Indicate P-value <0.05

(test statistic = linear regression)

^a Adjusted for ethnicity, education and household composition.

^b Adjusted for age, gender, ethnicity, education and marital status.

^c Adjusted for age, gender and marital status.

^d Adjusted for age, gender and ethnicity.

- ^e Adjusted for age, ethnicity and household composition.
- ^f Adjusted for gender, ethnicity, education and household composition.
- ^g Adjusted for age and ethnicity.
- ^h Adjusted for age, ethnicity, marital status and household composition.
- ⁱ Adjusted for age, gender, ethnicity and education.
- ^j Adjusted for age, gender and education.