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Household food insecurity and ideal cardiovascular health factors in U.S. adults

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Food insecurity is a condition of limited food availability due to a lack of money and resources, affecting 12.7% of households in 2015.¹ Food insecurity has been previously associated with poor diet quality and obesity, which may have long-term implications for chronic disease.^{2,3} In 2011, the American Heart Association (AHA) defined ideal cardiovascular health (CVH) as adherence to seven health factors and behaviors,⁴ ranging from physical activity to blood pressure and total cholesterol, which have been associated with lower risk of major chronic disease and mortality.^{5,6} However, populations vulnerable to food insecurity may be less likely to achieve ideal cardiovascular health. The objective of this study was to examine the associations between household food insecurity and ideal CVH metrics in a national sample of US men and women.

METHODS

Data came from 2007–2012 of the National Health and Nutrition Examination Surveys (NHANES). Participants were 7,802 adults (ages 20–65 years) with household incomes 300% of the federal poverty level (FPL), in order to reduce the potential for confounding by socioeconomic status. The primary exposure was household food insecurity, measured using the US Food Security Survey Module. Food insecurity was categorized as follows: 0 affirmative responses, food security; 1–2 affirmative responses, marginal food security; and 3 affirmative responses, food insecurity. The outcomes were attainment of four health behaviors (smoking, body mass index (BMI), diet, physical activity, and smoking) and three health factors (blood pressure, fasting plasma glucose, and total cholesterol), as defined by AHA.⁴ Because <1% of adults in the study met the ideal diet criteria, we re-defined ideal diet as being the upper two quintiles of Alternate Healthy Eating Index-2010. Logistic regression models examined associations between household food insecurity and ideal cardiovascular health metrics. Heterogeneity by sex was determined using a Wald test. All models adjusted for age, sex, race/ethnicity, educational attainment, marital status, and household income, and incorporated sampling weights recalculated to reflect sampling probabilities and participation rates across the study period.

RESULTS

In the study sample, 57.7% of adults were food-secure, 15.1% were marginally food-secure, and 27.2% were food-insecure. After multivariable adjustment, food insecurity was inversely associated with ideal smoking (OR 0.58, 95% CI 0.48–0.70) (Table 1). Associations for BMI, physical activity and diet differed by sex. Food insecurity was inversely associated with ideal physical activity (OR 0.71, 95% CI 0.58–0.87) in men, and ideal BMI (OR 0.71, 95% CI 0.57–0.89) and diet quality (OR 0.71, 95% CI 0.54–0.93) in women. There were graded associations between household food insecurity and meeting ideal CVH metrics (Table 2). Compared to food-secure adults, food-insecure adults had lower odds of meeting 3 metrics (OR 0.73, 95% CI 0.60–0.89, $P=0.002$), 4 metrics (OR 0.69, 95% CI 0.59–0.80, $P<0.0001$), 5 metrics (OR 0.63, 95% CI 0.49–0.81, $P=0.0003$), and 6 metrics (OR 0.50, 95% CI 0.30–0.84, $P=0.009$).

DISCUSSION

In this nationally representative study, household food insecurity was inversely associated with multiple health behaviors and clinical measures that collectively comprise ideal cardiovascular health. The constellation of these non-ideal CVH metrics may explain why food insecurity has been previously associated with diet-sensitive chronic disease, suggesting long-term implications for adverse cardiovascular health outcomes.^{2,3} This study is limited by the cross-sectional nature of the data, which precludes clear notions about temporality. However, corroboration of our results with prior studies helps lend confidence that health behaviors are affected by food insecurity, rather than vice versa.^{2,3} Results of this study highlight another important health consequence of food insecurity. Rather than focusing solely on nutrition, interventions or policies may want to consider a holistic approach to health promotion in order to reduce disparities among populations at risk for food insecurity.

References

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Table 1

Associations between household food insecurity and ideal cardiovascular health metrics^a

	All adults (n=7,802)			Men (n=3,766)			Women (n=4,036)		
	%	OR ^{b,c}	95% CI	%	OR ^b	95% CI	%	OR ^b	95% CI
Ideal smoking									
Food secure	71.6	Ref.	-	67.6	Ref.	-	75.4	Ref.	-
Marginally food secure	67.7	0.89	0.71, 1.11	62.9	0.90	0.70, 1.18	71.7	0.86	0.64, 1.16
Food insecure	54.8	0.58	0.48, 0.70	49.3	0.58	0.46, 0.75	60.0	0.56	0.43, 0.71
Ideal body mass index (BMI)									
Food secure	32.8	Ref.	-	31.8	Ref.	-	33.7	Ref.	-
Marginally food secure	28.7	0.80	0.66, 0.96	31.8	0.99	0.77, 1.29	26.1	0.67	0.51, 0.87
Food insecure	28.0	0.78	0.68, 0.91	29.6	0.86	0.70, 1.05	26.4	0.71	0.57, 0.89
Ideal physical activity									
Food secure	34.4	Ref.	-	39.4	Ref.	-	29.7	Ref.	-
Marginally food secure	26.9	0.77	0.63, 0.94	34.1	0.88	0.65, 1.20	21.1	0.68	0.53, 0.86
Food insecure	25.6	0.77	0.65, 0.91	28.3	0.71	0.58, 0.87	23.1	0.85	0.65, 1.11
Ideal diet									
Food secure	43.7	Ref.	-	43.0	Ref.	-	44.3	Ref.	-
Marginally food secure	39.9	0.93	0.70, 1.22	43.3	1.10	0.75, 1.63	37.2	0.80	0.59, 1.09
Food insecure	32.6	0.77	0.62, 0.96	34.2	0.84	0.62, 1.13	31.2	0.71	0.54, 0.93
Ideal total cholesterol									
Food secure	58.9	Ref.	-	59.1	Ref.	-	58.7	Ref.	-
Marginally food secure	58.4	0.93	0.80, 1.09	57.3	0.93	0.74, 1.17	59.4	0.94	0.71, 1.23
Food insecure	56.2	0.86	0.72, 1.02	55.2	0.86	0.67, 1.10	57.1	0.84	0.66, 1.05
Ideal blood pressure									
Food secure	55.6	Ref.	-	47.3	Ref.	-	63.3	Ref.	-
Marginally food secure	54.3	0.88	0.76, 1.02	44.8	0.91	0.71, 1.16	62.3	0.84	0.64, 1.10
Food insecure	58.3	1.09	0.94, 1.28	50.8	1.20	1.01, 1.44	65.2	0.97	0.74, 1.27
Ideal fasting glucose									
Food secure	56.4	Ref.	-	46.5	Ref.	-	65.5	Ref.	-
Marginally food secure	55.4	0.92	0.70, 1.22	49.3	1.12	0.69, 1.82	60.1	0.75	0.51, 1.12

	All adults (n=7,802)		Men (n=3,766)		Women (n=4,036)				
	%	OR ^{b,c}	95% CI	%	OR ^b	95% CI			
Food insecure	53.1	0.90	0.74, 1.09	47.5	1.00	0.73, 1.38	59.0	0.77	0.56, 1.05

^a Definitions for ideal cardiovascular health metrics: ideal smoking, never smoking or quitting >1 year ago; ideal BMI, <25 kg/m²; ideal physical activity, 75 minutes of vigorous activity or 150 minutes of moderate activity a week; ideal diet, upper two quintiles of the Alternate Healthy Eating Index-2010; ideal total cholesterol, <200 mg/dL; ideal blood pressure, <120 mmHg/<80 mmHg; ideal fasting glucose, <100 mg/dL.

^b All models adjusted for age, sex (except stratified models), race/ethnicity, educational attainment, marital status, and household income.

^c P-values from Wald tests for heterogeneity of OR by sex were: 0.97 for ideal smoking; 0.03 for ideal BMI; 0.08 for ideal physical activity; 0.07 for ideal diet; 0.87 for ideal total cholesterol; 0.62 for ideal blood pressure; and 0.22 for ideal fasting glucose.

Table 2

Odds ratios for combined ideal cardiovascular health metrics by household food insecurity status^a

	All adults (n=7,802)			Men (n=3,766)			Women (n=4,036)		
	%	OR ^{a,b}	95% CI	%	OR ^a	95% CI	%	OR ^a	95% CI
3 ideal factors									
Food secure	64.4	Ref.	-	61.7	Ref.	-	67.0	Ref.	-
Marginally food secure	60.6	0.87	0.68, 1.12	59.8	0.97	0.69, 1.37	61.2	0.81	0.59, 1.10
Food insecure	52.6	0.73	0.60, 0.89	47.9	0.70	0.51, 0.95	57.0	0.73	0.56, 0.96
4 ideal factors									
Food secure	41.1	Ref.	-	40.0	Ref.	-	42.2	Ref.	-
Marginally food secure	30.8	0.64	0.50, 0.82	30.7	0.72	0.51, 1.01	30.8	0.59	0.44, 0.79
Food insecure	28.2	0.69	0.59, 0.80	23.9	0.63	0.50, 0.80	32.2	0.71	0.55, 0.91
5 ideal factors									
Food secure	19.8	Ref.	-	17.2	Ref.	-	22.3	Ref.	-
Marginally food secure	11.6	0.52	0.38, 0.72	12.1	0.66	0.40, 1.09	11.2	0.44	0.31, 0.63
Food insecure	11.4	0.63	0.49, 0.81	9.6	0.64	0.44, 0.94	13.1	0.60	0.42, 0.87
6 ideal factors									
Food secure	6.5	Ref.	-	5.4	Ref.	-	7.6	Ref.	-
Marginally food secure	4.0	0.64	0.38, 1.09	4.5	0.97	0.41, 2.31	3.5	0.48	0.27, 0.85
Food insecure	2.6	0.50	0.30, 0.84	2.1	0.47	0.24, 0.92	3.1	0.48	0.23, 1.03

^aAll models adjusted for age, sex (except stratified models), race/ethnicity, educational attainment, marital status, and household income.

^bP-values from Wald tests for heterogeneity of OR by sex were: 0.57 for 3 ideal factors, 0.22 for 4 ideal factors; and 0.31 for 5 ideal factors; and 0.35 for 6 ideal factors.